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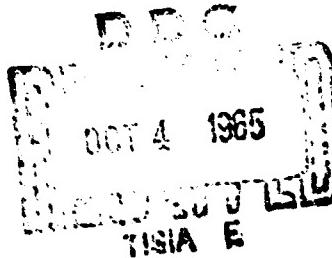
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TECHNICAL REPORT 71

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TOBACCO GROWING  
AND ECONOMICS OF TOBACCO  
IN SELECTED COUNTRIES OF THE WORLD

Paul J. Wuest

SEPTEMBER 1965



UNITED STATES ARMY  
BIOLOGICAL LABORATORIES  
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**U.S. ARMY BIOLOGICAL LABORATORIES  
Fort Detrick, Frederick, Maryland**

**TECHNICAL REPORT 71**

**TOBACCO GROWING AND ECONOMICS OF TOBACCO IN  
SELECTED COUNTRIES OF THE WORLD**

**Paul J. Wuest**

**Crops Division  
DIRECTORATE OF BIOLOGICAL RESEARCH**

**Project 10522301A06101**

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ABSTRACT

Information on tobacco is compiled chiefly for the period 1950-1963, although some data go as far back as 1935. The report furnishes background information for the layman and researcher on tobacco types, field culture, curing, production by countries, trade, and diseases. Terms that might be confusing are defined. Data are summarized in tables on market value of tobacco by types, production of and trade in the product by countries. Major geographical areas, acreage, money value of tobacco, yields per unit area, bilateral trade agreements between importing and exporting countries, and licensing and exchange requirements for selected countries are also presented.

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## I. INTRODUCTION

Tobacco is a unique agricultural crop. It is unique because it has been cultured for many years, in many ways, for many purposes. The layman who attempts to understand the numerous facets of tobacco production is easily frustrated by the many terms that have multi-purpose definitions. These terms apply in one instance to the growing crop, and in another instance to the curing crop. Different growing regions also have their own colloquialisms. Thus, the first goal of this report is to define the terms associated with tobacco production around the world (Section II).

Diversity of the crop is also confusing. Some countries produce one kind of tobacco; other countries produce many. Climate, soils, international trade agreements, and internal demand all affect the selection of tobacco types to be grown. If the diversity of the crop followed geographical borders, it would be rather simple to define tobacco culture. However, each country of each continent adds to the diversity, thus it does not lend itself to generalizations (Section III).

One of the factors that affects the kind of tobacco in a given country is the international trade agreements. These have evolved over the years and it is difficult to determine if the agreements were made before the tobacco was first planted or vice versa. Tobacco was used in international trade before the founding of the colonies in the New World. Tobacco means money to many nations; the factors affecting price, marketability, and type of leaf produced are discussed in Section IV.

Tobacco diseases are a deterrent to production and often a major factor when international commitments cannot be fulfilled. The loss of millions of dollars every year is directly attributed to tobacco diseases. A number of diseases, their mode of action, and the environments that favor them are discussed in Section V.

This report contains a country-by-country account of tobacco production past and present in an effort to clearly explain the culture of tobacco on a world-wide basis. The material is a compilation of information obtained from many sources. Only a small amount of the information originated with the author, and this represents the synthesis of an idea from personal communication and/or reference material. The USDA, FAO, and certain land-grant institutions in the tobacco-growing areas are the major sources of information for this report.

## II. TOBACCO TYPES AND CULTURE<sup>1,2</sup>

Tobacco is broadly classified into several types because of distinct curing methods, specific growing areas, or particular use made of the product. The major types are flue-cured, fire-cured, air-cured, cigar, perique, and oriental. The first three types are identified by their processing; cigar tobacco is typed according to its ultimate utility; and perique and oriental are related to distinct growing areas.

### A. TYPES

#### 1. Flue-Cured

Tobacco is flue-cured by heat that is piped through flues in a closed barn. Flue-cured tobacco is the major constituent of blended tobacco and is also used for some pipe tobacco. Better grades of this type have bright yellow leaves, but color also depends on soil type, varieties planted, fertilization procedure, and method of curing.

Flue-cured tobacco is grown in southern Virginia, central and eastern North Carolina, eastern South Carolina, southeastern Georgia, and northern Florida. The Coastal plains and the Piedmont regions of those states are ideal for its culture because of their sandy and fine-sandy loam soils. Subsoils of gravel and sand are easily leached and clay subsoil causes waterlogging. Neither leaching nor waterlogging is desirable for tobacco growing.

#### 2. Air-Cured

Tobacco that is air-cured is used in cigarette blends, pipe mixtures, and for chewing. It is differentiated from all other types grown in the United States by the light green or cream stalks and leaf midribs.

##### a. Light-Air-Cured

###### (1) Burley

In the United States, production of burley tobacco ranks next to flue-cured. It is grown principally on silt-loam soils of limestone origin in the bluegrass region of Kentucky, in Tennessee, Virginia, western North Carolina, and Ohio. Plants producing the finest grade of tobacco are grown in virgin soil or in soil following a six-year cover crop of bluegrass.

## (2) Maryland

Maryland tobacco is used principally in the manufacture of blended cigarettes. It is grown in the southern counties of Maryland and thrives on light-brown loamy sand or light sandy loam soil. The subsoil is characterized by a yellow- or red-brown sandy clay that is either crumbly or friable, or a heavy sandy loam that affords good but not excessive drainage.

## b. Dark Air-Cured

The dark air-cured tobacco of Kentucky, Tennessee, and Virginia is grown in the same areas and sometimes on the same farms where fire-cured and burley are grown. This tobacco is used for chewing and for pipes.

## 3. Fire-Cured

Fire-cured tobacco is dark, with a heavy body and a distinctive flavor imparted by the smoke of open fires during curing. This type is used for snuff, plug tobacco, and wrappers and Italian cigars. Most of the tobacco is grown in central Virginia, western Kentucky, and northern Tennessee.

Economically, this tobacco is the least important.

## 4. Cigar

Although all cigar tobacco is air-cured, it is in a distinct type because of its ultimate utility. Cigar tobacco consists of three minor groupings: wrapper, binder, and filler. Wrapper leaf is grown in the Connecticut valley, western Florida, and southern Georgia; binder is grown almost exclusively in Wisconsin; filler is produced in New York, Pennsylvania, Ohio, and in Puerto Rico.

Cigar filler is produced from plants grown in Pennsylvania on silt loams of Duffield, Hagerstown, and Dunmore, all of limestone origin. Miami and Crosby silt loams and Brookston silty-clay loam are the principal soil types planted to this tobacco in Ohio. These soils are well adapted to general farming and tobacco is grown in rotation with other crops. The subsoil sometimes requires tile drainage to prevent waterlogging.

Cigar binder is produced from plants grown in three types of soil, sandy loam, dark prairie, or light clay loam.

Shade-grown wrapper tobacco of Florida and Georgia thrives on fine sandy to sandy loams with a well-drained subsoil. In Connecticut it thrives on Merrimac coarse, sandy loam.

### 5. Perique

The varieties of perique tobacco grown and methods of culturing resemble those used in producing fire-cured tobacco. The leaves are air-cured a maximum of 14 days then processed under pressure for 2 weeks, during which time the tobacco is repacked every other day. Following this procedure but still under pressure, the tobacco ferments in its own juice for about one year before it is marketed.

### 6. Aromatic

Aromatic tobacco, often referred to as Turkish or oriental, is grown in Greece, Turkey, Bulgaria, and the USSR. This tobacco is used by the cigarette industry in the United States.

All phases of aromatic leaf production and curing are covered extensively by Wolf.<sup>8</sup>

## B. CULTURE

### 1. Seedbed Location and Preparation

Whenever feasible, seedbeds, usually 3 to 4 feet wide, are located on virgin soil in wooded areas with a southern exposure. Because tobacco seeds are extremely small, the soil must be raked, pulverized, and sterilized to assure a good stand. A common practice in most of the tobacco-growing areas in this country is to fumigate the seedbed.

Fertilizer is broadcast over the seedbed and worked in before seeding. Tobacco seeds are mixed with inert material at the rate of one ounce per bushel of sifted sawdust, ashes, or bonemeal and broadcast onto the beds. The seedbed is rolled or trampled after broadcasting and covered with polyethylene or a tobacco cloth to insure good seed germination.

### 2. Transplanting

The tobacco seedlings are transplanted when they are 5 or 6 inches tall and 4 to 6 leaves have formed. The soil is wetted before plants are pulled from the seedbed to minimize damage to roots. Plants are set in holes 4 to 6 inches deep and the depression filled with water or a transplant solution. Cultivation and fertilization practices vary according to the type of tobacco grown.

Plants are topped and suckered a few weeks after transplanting. The remaining leaves increase in size and weight because of this procedure. This technique varies with the type of tobacco grown and the desired end-product. Topping is a manual task because it involves breaking the stems

before or at the time of flower initiation. Chemicals are used to control growth of suckers, but at present their use is limited to the United States.

### 3. Harvesting

Priming, a term for picking leaves as they mature, is the procedure used to harvest top-quality tobacco such as aromatic, flue-cured, and some cigar types. When top quality is not desired, the plants are cut at ground level, and the leaves are allowed to wilt before they are stripped. This technique is less expensive but it yields leaves at all stages of development.

### 4. Processing

#### a. Curing

Curing relates to metabolic processes of the living cell under conditions of progressive drying. As the moisture level is reduced, microbial activity is restricted. Regulation of temperature and moisture aid in developing the color desired. Curing stripped or primed leaves requires different management because there is no translocation of materials in primed leaves. Air-curing requires several weeks, flue-curing 4 to 5 days, and fire-curing approximately 3 weeks.

Leaves that are fire-cured are allowed to wilt and yellow in the barns before the process begins. Heat from open hardwood fires on the floor of the curing barn dries the leaves and the smoke imparts a characteristic flavor and aroma to the tobacco. About three weeks of smoke with alternating fire and fireless periods are needed to dry and cure the tobacco.

#### b. Fermenting

Fermenting is a residual intracellular activity after death along with some activity by microflora. This process is an integral part of tobacco manufacturing. It causes the development of the desired flavor and aroma and eliminates the rawness or harshness of freshly cured leaf. Fermentation is the resumption of reactions taking place in the later stages of barn-curing that cease when the leaves are dried.

Excessive moisture causes leaf decay by the microflora; therefore, controlling leaf moisture is of primary importance during the fermentation process. The equipment necessary for moisture control is owned and operated by commercial organizations. Farmers sell their crops after curing but prior to fermenting.

Tobacco ferments for one to two years and during this interval of time, it is periodically processed through a machine that adjusts the moisture content to the proper level. The tobacco is then repacked and placed in hogsheads or bins.

### c. Aging

Aging is a continuation of the fermentation process, but at a much slower rate. Most tobaccos must be aged a minimum of one year; some of the cigar tobaccos must age two or three years.

The total time involved in preparing green tobacco for commercial use is two to five years.

## 5. Specific Requirements for Curing

### a. Flue-Curing

The three stages for flue-curing are (i) yellowing - temperature at 80 to 90 F, slowly increased to 110 or 120 F, leaf becoming yellow in 24 to 36 hours; (ii) fixing the color - temperature increased gradually to between 130 and 140 F, leaf drying in 30 to 36 hours; and (iii) drying the stems ("killing-out" stage) - temperature increased to between 165 to 170 F at rate of 5 F per hour and maintained an additional 40 hours until stems are dry.

The total time involved for flue-curing is 4 or 5 days.

### b. Air-Curing

Satisfactory results occur only when weather conditions are favorable. Approximately 4 to 8 weeks are required for this process. When air-curing is initiated in an atmosphere with a high relative humidity (RH), supplemental heat is supplied.

The two stages for air-curing are (i) yellow stage - burley, Maryland, dark air-cured, and cigar tobaccos are exposed to temperatures ranging from 70 to 100 F and a RH of 85%. Burley yellows optimally with the RH at 70%. The first curing period is over when the leaves become yellow. They must be dried slowly or respiration will cease and leaf quality will be inferior. (ii) Brown or red stage - excessive moisture during this stage will cause the tobacco to cure with too dark a color. The leaf is dried rapidly until the stems become brittle.

### c. Sun-Curing

When tobacco is sun-cured, the leaf is exposed to the sun or open air for several days immediately after harvest. The curing is completed in a barn without artificial heat in 4 to 6 days, at which time the leaf is yellow. After this stage of development, sun-cured tobacco is processed the same as air-cured.

d. Fire-Curing

No heat is supplied during the first stage of yellowing. This period extends from 3 to 5 days after harvest. Slow fires are kept burning to increase temperature from 90 to 95 F until yellowing of leaf is completed; yellowing requires from 3 to 5 days. After this stage, the temperature is raised to 125 up to 135 F until the tobacco is dry. The entire process requires 6 to 10 days.

### III. WORLD PRODUCTION AND TRENDS

Tobacco as a commodity for international trade has been on the market for more than 300 years. Almost every country of the world is a tobacco producer, even though many countries supply only their own needs. Exports of both the raw material and the manufactured products account for about one-fifth of the entire harvest, indicating that the international tobacco trade involves a substantial sum of money.

Cigarette consumption has been increasing, and continues to increase; this changes the demand for specific types of tobacco. Flue-cured, burley, oriental, and Maryland types are being allotted greater acreage on the international level because they are needed in cigarette production. Dark air-cured and fire-cured types are still important in certain countries, but their world-wide importance is decreasing.

People the world over prefer blends similar to those used in the United States. These blends feature mild flavor and aroma - a characteristic of flue-cured tobacco, as opposed to cigarettes produced with dark air-cured or fire-cured tobacco. The preference for manufactured, blended cigarettes is attributed to world-wide increase in the standard of living. The impact of the current controversy over health and smoking is unknown, and generalizations cannot be made at present. It seems inevitable, however, that politicians will allow much time for deliberating legislation curbing the availability of tobacco. Many municipalities, states, and countries depend heavily on tobacco taxes.

Tobacco is a varied crop grown in numerous countries. It is not accurate to consider tobacco culture and production on a continental basis, but rather on a regional basis. This report, therefore, will attempt to include tobacco production in selected nations of the world giving as many details as are available.

#### A. EUROPE

Tobacco is used as a consumer commodity and an exchange item in most countries of the world. The total value of tobacco in each country can be reckoned only by studying the amount of tobacco produced within the country and the amount purchased or sold on the international market. Production and international trade for ten European countries are summarized in Tables 1 and 2.<sup>4-20</sup>

TABLE I. TOBACCO PRODUCTION IN EUROPE<sup>7, 9, 20</sup>

Country	Type	1947-51	1952-55 <sup>b</sup>	1956-59 <sup>a</sup>	1960-62 <sup>a</sup>	1963
thousands of pounds						
Bulgaria	Oriental	b	b	159,647	163,908	b
France	Air-cured, Maryland <sup>c</sup>	103,570	114,514	118,056	b	b
	Air-cured, Dark	5,500	2,467	120,416	80,242	95,680
	Burley	b	b	b	839	1,322
Greece	Oriental	113,320	222,953	199,767	186,593	257,425
	Burley	b	b	b	659	3,638
	Flue-cured	b	b	178	103	99
Hungary <sup>10</sup>	Oriental	b	b	21,801	17,073	b
	Air-cured, Maryland	b	b	7,564	4,350	b
	Air-cured, Dark	b	b	21,803	8,500	b
	Flue-cured	b	b	10,772	9,302	b
Italy	Oriental	52,900	32,176	44,950	23,562	38,814
	Burley	13,700	16,515	24,438	10,362	28,937
	Flue-cured	16,100	26,367	28,267	14,307	24,802
	Fire-cured	51,400	25,884	29,164	13,202	18,705
	Air-cured, Maryland	7,800	7,056	11,864	2,092	2,778
	Air-cured, Dark	22,000	25,831	27,837	13,213	21,301
Poland	Oriental	b	b	3,595	3,627	3,750
	Burley	b	b	137	200	300
	Flue-cured	b	b	39,940	44,927	54,123
	Fire-cured	b	b	20,297	17,225	18,250
	Air-cured, Dark	b	b	29,235	24,436	30,500
Romania	Oriental	b	b	57,905	36,542	b
	Air-cured, Dark	b	b	5,960	2,700	b
Spain	Air-cured, Maryland	b	13,228	5,561	b	b
	Air-cured, Dark	27,200	22,763	20,546	26,322	24,144
	Burley	6,425	29,641	25,374	43,724	39,758
	Flue-cured	800	2,965	780	712	800
	Fire-cured	714	700	b	b	b
Yugoslavia	Oriental	52,674	80,503	88,911	43,704	103,608
	Air-cured, Dark	7,155	8,195	8,342	6,818	11,023
	Flue-cured	b	b	b	800	6,614
USSR	Oriental	b	b	198,801	211,000	234,000
	Air-cured, Dark	b	b	239,914	84,000	107,500

<sup>a</sup> Data in references compiled and averaged.<sup>b</sup> Data not available.<sup>c</sup> Figures represent production in French colonies.

TABLE 2. INTERNATIONAL TRADE OF UNMANUFACTURED TOBACCO LEAF IN EUROPE<sup>8, 20</sup>

Country	Exports	1935-39	1945-49	1950-54 <sup>a</sup>	1955-59 <sup>a</sup>	1962-63 <sup>a</sup>
thousands of pounds						
Bulgaria <sup>6</sup>	Exports	59,396	55,246	b	118,000	129,000
France <sup>11</sup>	Exports	686	577	1,183	4,740	5,615
	Imports	58,716	64,001	69,912	73,042	91,537
Greece	Exports	97,657	39,856	88,077	127,743	119,786
	Imports	20	b	b	3	4
Hungary <sup>10</sup>	Exports	19,162	b	b	b	1,300
	Imports	3,106	5,595	b	b	b
Italy	Exports	12,927	4,515	22,160	25,547	32,918
	Imports	5,253	16,578	8,290	17,073	69,745
Poland	Exports	149	b	b	500	860
	Imports	18,404	5,595	b	b	b
Romania <sup>20</sup>	Exports	b	b	b	480	720
Spain	Exports	b	b	b	2,445	337
	Imports	30,979	38,746	48,844	47,106	55,193
Yugoslavia <sup>17</sup>	Exports	10,362	17,867	15,712	39,723	34,490
	Imports	b	b	2,988	1,224	21,424
USSR	Exports	6,170	b	b	10	58

<sup>a</sup> Data in references compiled and averaged.

b Data not available.

### 1. Bulgaria<sup>4-6</sup>

Tobacco, the leading crop in Bulgaria, currently accounts for about one-third to one-half of the total agricultural export. More than 85% of the crop is exported either unmanufactured or in the form of cigarettes. In 1963, exports of tobacco exceeded \$70 million, \$45 million for leaf tobacco and \$30 million for cigarettes. Bulgarta, a state corporation, controls the crop from planting to exporting.

The four most important tobacco-growing regions are Macedonia, Plovdiv, Khoskovo, and Djebel, located in southern Bulgaria. Many hill-sides between the lower Balkan mountains and higher Rhodope mountains on the Greek border are covered with tobacco. Farmers in the Maritsa valley between the two mountain ranges often raise fruits and vegetables at lower elevations and tobacco on the more rolling land. Most types of oriental tobacco grown there are named for the districts in which they are grown.

The Macedonian region is located in the southwestern corner of the country south of Sofia. Tobacco produced in the Dupnitsa vicinity is light in color, has medium-sized leaves, is low in nicotine, and yields mild smoke. Tobaccos grown in the Gorna-Dzhumay province are similar to those grown in the neighboring Dupnitsa province. Tobacco produced in Melnick province on the Greek border has large, light-orange and golden leaves. The highly elevated area of Nevrokop produces the large-leaved Basma tobacco with characteristic orange or light-red leaves. Tobacco cultivation has expanded rapidly in the Plovdiv region, located in the south central part of the country. Tobacco produced near the city of Plovdiv, on the Maritsa river, is popular on the world market because of its aroma and taste.

The Peruchtitza-Ustina province produces tobacco with a strong aroma and sweet smell. Pechtera and Pazardjik tobaccos also have a strong aroma. Tobacco of the Assenovgrad vicinity is used to neutralize stronger blends.

The Haskova region is located in southeastern Bulgaria near the Turkish border. The stronger types grown in the area include Haskovo, Krumovgrad, and Tekne; the milder and lighter include Ivilovgrad, Ortakjoi, Havmanli, and Svilengrad.

The Djebel region is located on the southern slopes of the Rhodope mountains. In this region the best quality of tobacco grows at elevations exceeding 2,800 feet.

The climate of Bulgaria is influenced by both the Mediterranean and Continental climates. The autumns are usually prolonged and mild, and the summers are not excessively hot. Very little rainfall occurs during summer and fall. Snow falls in the mountains during the winter and provides water for irrigation during the spring and early summer. At lower elevations, winter rains benefit tobacco seedbeds.

Tobacco is transplanted in May, some of it by mechanical planters belonging to a cooperative of tobacco farmers. In June, the weeds are eliminated and the rows of young plants are cultivated.

Flue-cured production has expanded in the smallest tobacco-growing area in northern Bulgaria. Sandy-loam soils near the Danube are favorable for flue-cured production; this tobacco accounts for 10% of the total production. A small amount of dark air-cured is produced in the same area with oriental tobacco. Oriental represents approximately 90% of production.

Seven experiment stations strive to improve the tobacco crop or its culture and handling. These are located at Plovdiv, Sandanski, Goze, Deltzhev, Djebel, Harmanli, and Kozarsko.

About one-half of the oriental crop is produced in the Plovdiv region where the leading varieties are Peruchtitza, Plovdiv, Pechtera, Pazardjik, and Assenovgrad. The Djebel region, including the southern ridges of the Rhodopes, produces about 15% of the crop and grows the following varieties: Momtchilgrad, Zlatograd, Kirdjali, Ardino, and Smolyan. These varieties are named for their home districts.

#### 2. France<sup>4,11</sup>

The chief tobacco-growing area of France is the Garonne valley near Bordeaux where sandy loam soils and a mild climate favor the production of dark air-cured tobacco. Perigueux, Bergerac, Tonneins, and Cahors are important towns in this area that produces more than one-half of the total crop. Farms near Strasbourg on the Rhine river account for about 18% of the crop. The remainder is produced in the vicinity of Angers, Poitiers, Grenoble, and Chambery. Tobacco is rarely grown north of Paris.

Production of dark air-cured tobacco represents 98% of the total French crop. Paraguayan varieties comprise 90% of the crop yield; the remaining varieties are Dragon Vert and Nijkerk. Lighter varieties of the dark air-cured leaf are used for cigarettes and smoking tobacco. Some Dragon Vert, Nijkerk, and Auriac of the darker types are used for chewing and snuff.

Burley, flue-cured, and round-tip (for cigars) production has increased appreciably in the last eight years, but still represents only 8% of total production.

#### 3. Greece<sup>4,12,13</sup>

Approximately 135,000 farmers in northern Greece account for 70% of the total production. Oriental tobacco presently accounts for more than 95% of the production. The principal varieties of the oriental

type in order of importance are Basma, Samsoun, Koulak, Smyrnia, Bagli, and Trapegrad. The principal growing areas are Macedonia, western Thrace, and south central Greece.

Tobacco is Greece's principal earning product of foreign exchange. The country is the fourth largest exporter of cigarette tobaccos and the second largest grower of oriental tobacco.

Production of burley has been initiated on a trial basis, mostly in central Macedonia and Thessaly. Many other areas are being tested because the returns to growers are much greater for burley than they are for oriental leaf. The National Tobacco Board is underwriting the costs of this experiment and has helped build the needed curing barns. One handicap in burley production could be the need for irrigation. In 1961, 250,000 pounds were grown and in 1964 more than 6 million pounds.

#### 4. Hungary<sup>7,10</sup>

Tobacco produced in Hungary is generally not for export. Trade within the "bloc countries" does exist but data are not available.

#### 5. Italy<sup>4,14</sup>

Italy produces many types of tobacco but about 26% of the total crop is oriental. Flue-cured accounts for 16%; burley, 17%; Kentucky fire-cured, 16%; Maryland, 8%; and all other kinds of dark air-cured tobaccos the remaining 17%.

The principal tobacco-growing areas in Italy are within the provinces of Puglia, Campania, Venetao, and Umbria. These provinces account for more than 75% of the total acreage and production. About 72% of the oriental and semioriental tobacco is produced in Puglia province. Also, important quantities of these two types are produced in Basilicata and Lazio. Maryland is produced mainly in Campania province, along with a minor quantity in Lazio. Campania province is also the principal burley area, accounting for almost two thirds of total acreage. Fifteen per cent of the burley production is in Lombardia and 8% in Lazio. Bright Italia (flue-cured) is produced chiefly in Umbria and Veneto provinces. Small acreages are also planted in Lazio and Toscana. Cigar tobaccos are grown mainly in Veneto, Campania, and Umbria provinces. Campania accounts for practically all of the Beneventano leaf, and Veneto accounts for the Nostrano leaf. Kentucky fire-cured tobacco is grown principally in Toscana, Umbria, Campania, and Veneto provinces.

Italy is the second largest European tobacco producer, surpassed only by Greece. Eighty per cent of their tobacco export consists of shipments of oriental, Kentucky fire-cured, and burley combined.

6. Poland<sup>4,7</sup>

Flue-cured is the major tobacco produced in this country. Dark air-cured, fire-cured, oriental, and burley are also produced but on a much smaller scale.

7. Romania<sup>4,7</sup>

Oriental is the main type of tobacco produced in this country. Production is centered in the northeastern corner of the country adjacent to the Black Sea.

8. Spain<sup>4,7,16</sup>

Spain is not self-sufficient in domestic tobacco production and must import about 45% of its annual leaf requirements.

Three areas account for about 70% of total production: (i) Cacera province - the burley area, (ii) Granada province - the flue-cured area, and (iii) Toledo province. Tobacco is also produced in the Valencia, Sevilla, and Badajoz areas. Burley accounts for more than 60% of the total production. This is followed by dark air-cured and a small amount of flue-cured tobaccos.

Tobacco production of the lighter types is expected to rise in the future.

9. Yugoslavia<sup>4,7,16,17</sup>

Yugoslavia produces three principal types of tobacco; all are air-dried. They are listed in order of their importance: (i) oriental, the main crop, is grown principally in Macedonia; (ii) hercegovinia, a semioriental; and (iii) vojvodinia, which is consumed within the country.

Both the oriental and semioriental types are also produced in Servia, Kostnet, and Croatia. The Vojodian and Slovenia areas in north-eastern Yugoslavia produce only cigar and other dark types.

About 90% of Yugoslavian tobacco is oriental or semioriental.

10. USSR<sup>4,7</sup>

There are three main types of leaf tobacco grown in the Soviet Union—dark air-cured, oriental (yellow leaf), and light air-cured. The principal kinds cultivated include Nakhorka (N. rustica) and oriental with lesser quantities of Maryland, burley, and miscellaneous types.

The principal regions where tobacco is grown include the Ukraine, Krasnodar, central Asia, Moldavia, Georgia, Armenia, and Azerbaijan. Nakhorka is grown principally in the Ukraine, the central black-soil region of European USSR, and western Siberia. Bakoun, a pipe tobacco variety, is a dark air-cured type with less than 1% nicotine content grown principally in the Ukraine. Oriental tobaccos are produced in regions of the Crimea, Krasnodar, eastern Black Sea, central Asia, Ukraine, Abkhazya, and Transcaucasus.

The principal varieties of oriental leaf include Trapezond, Samsoun, Dubek, Tyk-kulah, and Ostrolist, all used mainly in cigarette production. Tobacco for cigars is grown mostly in the Ukraine, Abkhazya, and Bryansk regions.

The Soviet Union is a net exporter of tobacco leaf.

#### B. ASTA

Diversity in the intended usage of the tobacco crop by the 11 Asiatic countries causes a great variance in the national policies toward tobacco. Turkey, China, and Indonesia use tobacco primarily as a source of international revenue; India, Japan, and Malasia produce tobacco for domestic consumption. These variances are illustrated by comparing data for both production and international trade (Tables 3 and 4).<sup>21-23</sup>

##### 1. Burma<sup>4,7</sup>

The major type of tobacco produced in this country is flue-cured. It does not represent any substantial part of the agricultural export dollar. A quantity of native tobacco is produced and used for handmade cigars and cheroots.

The major growing areas lie along the Irrawaddy river from Kama to the Hengzada border, and in the Toungoo district. Some tobacco is grown in the Shan states.

##### 2. Cambodia, Laos, Vietnam<sup>18,19,4,7</sup>

These three countries constituted French Indo-China until 1946 when they became independent countries tied to France and to each other. Since then ties between these countries have been broken.

Tobacco is grown by many farmers throughout these countries, but large-scale production of a quality product does not exist. The largest areas of tobacco production are in Vietnam and Cambodia in the Tonkin Delta at Nam-Dinh, the Tourane-Faifoo region in Annam, and the area

TABLE 3. TOBACCO PRODUCTION IN ASIA

Country	Type	1947-51	1952-55 <sup>a</sup>	1956-59 <sup>a</sup>	1960-62 <sup>a</sup>	1963
thousands of pounds						
Burma <sup>7, 9, 10</sup>	Sun-cured, Dark	b	b	87,859	89,703	85,120
	Flue-cured	88	430	3,181	3,883	3,840
Cambodia, Laos and Vietnam <sup>10, 18</sup>	Flue-cured	b	b	1,920	7,000	10,000
	Air-cured, Dark	b	b	28,504	24,500	20,000
Malaya <sup>10, 18</sup>	Flue-cured	b	b	b	100	b
	Sun-cured, Dark	b	b	b	5,000	b
India <sup>7, 9</sup>	Sun-cured, Light	79,000	86,303	78,916	83,500	85,000
	Sun-cured, Dark	402,000	331,680	387,648	478,682	537,110
	Flue-cured	64,510	127,680	131,000	159,000	147,500
Indonesia <sup>7, 9</sup>	Flue-cured	1,670	24,762	31,627	46,843	48,501
	Air-cured, Dark	61,450	105,272	113,339	110,148	116,844
	Fire-cured	b	b	b	551	2,204
Iran <sup>7, 9, 21</sup>	Air-cured, Dark (Tombac)	26,843	30,533	28,141	20,872	25,353
	Sun-cured, Dark	7,989	3,962	2,345	1,376	2,200
	Flue-cured	b	b	b	1,138	2,500
Iraq <sup>7, 9, 21</sup>	Oriental	2,645	5,589	6,843	6,550	5,350
	Burley	2,640	5,004	2,842	2,500	2,000
	Flue-cured	1,323	3,370	5,059	10,450	7,000
Pakistan <sup>7, 9, 21</sup>	Air-cured, Dark (Tombac)	200	201	308	911	1,258
	Oriental	b	11,039	13,308	14,500	16,000
	Burley	b	6,000	6,805	4,720	5,200
Thailand <sup>7, 9, 21, 22</sup>	Flue-cured	1,581	9,000	13,100	21,000	26,000
	Sun-cured, Dark	b	135,000	112,100	69,340	74,500
	Sun-cured, Light	b	12,000	14,800	17,002	18,500
Turkey <sup>7, 9, 21</sup>	Air-cured, Dark	112,302	81,000	74,700	71,632	72,500
	Fire-cured	b	850	1,320	3,750	4,500
	Oriental	b	b	b	140	165
China, Mainland <sup>7, 9, 23</sup>	Burley	b	b	b	462	714
	Flue-cured	8,200	21,907	18,435	23,416	21,425
	Sun-cured, Dark	27,000	32,492	37,691	40,124	44,092
Best Available Cop	Oriental	193,749	248,189	259,426	205,612	275,575
	Air-cured, Dark	360	1,200	735	625	1,000
	Sun-cured, Light	520,000	525,000	513,202	590,000	b
	Sun-cured, Dark	125,000	105,000	101,318	65,000	85,000
	Burley	b	b	646,000	760,000	b
	Flue-cured	250,000	525,000	603,651	750,000	b
	Air-cured, Dark	500,000	480,000	480,000	469,429	b

<sup>a</sup> Data in references compiled and averaged.<sup>b</sup> Data not available.

TABLE 4. INTERNATIONAL TRADE OF UNMANUFACTURED TOBACCO LEAF IN ASIA<sup>20</sup>

Country	Trade	1935-39	1945-49	1950-54 <sup>a</sup>	1955-59 <sup>a</sup>	1962-63 <sup>a</sup>
Thousands of pounds						
Burma <sup>8</sup>	Exports	b	b	395	290	16
	Imports	b	b	288	835	b
Cambodia <sup>10, 18</sup>	Exports	216	b	1	1,291	b
	Imports	2,718	4,937	12,748	1,445	3,127
Laos <sup>10, 18</sup>	Imports	b	b	b	967	1,100
Vietnam <sup>10, 18</sup>	Exports	b	b	b	299	b
	Imports	b	b	b	8,023	5,515
Malaya <sup>10</sup>	Exports	b	b	175	2,590	236
	Imports	b	b	462	4,673	16,434
India <sup>8</sup>	Exports	43,500	61,615	84,405	92,265	147,864
	Imports	4,791	11,262	4,354	3,195	1,715
Indonesia <sup>8</sup>	Exports	101,176	5,970	30,192	33,116	26,445
	Imports	2,765	4,760	13,484	15,430	2,315
Iran <sup>8, 21</sup>	Exports	b	394	4,994	1,227	442
Iraq <sup>8, 21</sup>	Exports	b	b	b	829	b
Pakistan <sup>8, 21</sup>	Exports	b	b	20	196	500
	Imports	b	1,721	7,453	1,531	3,000
Thailand <sup>8, 21</sup>	Exports	13	b	21	8,333	6,580
	Imports	3,405	1,745	5,488	10,292	8,262
Turkey <sup>8, 21</sup>	Exports	75,490	105,371	132,971	146,417	154,372
	Imports	152	b	12	b	b
China, Mainland <sup>8, 23</sup>	Exports	30,994	1,209	b	93,000	36,000
	Imports	56,613	24,647	b	b	b

<sup>a</sup> Data in references compiled and averaged.<sup>b</sup> Data not available.

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around Gia Dinh, Hoc Mon, and Kompong Cham in South Vietnam and Cambodia. About 90% of the crop is dark, air-cured, and is used for domestic consumption as cigarette or chewing tobacco.

Tobacco is a dry-season crop and is normally seeded in September through November. Fields are irrigated frequently until the tobacco matures. The crop is harvested 4 to 6 months after planting.

The most suitable regions for cultivating light tobacco are the mountainous areas of Tonkin and Annam, with soils derived from crystalline rocks and basalt. The highest quality is grown near the Col d'Ai Lao in the valley of the Song Ba.

a. Cambodia

Native, dark tobacco is grown almost exclusively. About 40% of the 10,000 tons produced yearly is earmarked for export.

b. Laos

The climate of Laos is tropical with two distinct growing seasons: (i) the farming season from May or June through October - the rainy season, and (ii) the nonfarming season during the remaining months when there is no rainfall.

Tobacco is grown in the upland areas, particularly in the Boloven plateau.

c. Vietnam

Vietnam consists of three distinct regions that produce tobacco: the Northern, formerly Tonkin; the Central, formerly Annam; and the Southern, formerly Cochinchina.

3. Malaya<sup>30,4,7</sup>

Total domestic production is estimated at 5 million pounds annually. Dark sun-cured tobacco is the main type grown, but large quantities of flue-cured are also produced. Tobacco must be imported to satisfy domestic consumption.

Flue-cured tobacco is grown relatively close to the Perak river on the mountainsides adjacent to the Lengong area. The cultural practices are advanced and seed is obtained from Rhodesia, United States, and Sumatra. Soils are brown sandy loam, grey silt loam, and eroded red clay.

Native tobacco is produced south of Ipoh in the general area of Telok Anson and closer to the border states of Perak and Selangor. Some native tobacco is also produced in the Lengong area.

The Malayan Tobacco Company is experimenting with flue-cured production along the west coast around the seaport of Kota Bahru. Fields are located on either side of the Kelantan river mostly south and west of Kota Bahru.

Organic fertilizers are used extensively and little mechanization exists. It seems that Malaya will soon produce its own requirements for flue-cured tobacco. It is worth about \$0.50 per pound to the farmer. Dark sun-cured is worth much less.

#### 4. India<sup>19-21,7,8</sup>

This nation is the second largest producer and the third largest exporter of leaf tobacco. In a land so large, diversity of the crop, viz., culture, handling, fertilizing, varieties, types, etc. is tremendous. Tobacco is produced for seven categories of use. The following tabulation shows pounds produced for each category, and the per cent of total poundage in each category. These figures are from 1957 but should reflect current trends.

	<u>Thousands of Pounds</u>	<u>% of Total</u>
Cigarettes		
Virginia flue-cured	129,473	17.5
Other types	59,965	8.2
Bidis	179,766	24.4
Chewing	154,679	21.1
Hookah and Chillum	141,941	19.2
Cigars and Cheroots	61,360	8.4
Snuff	<u>8,716</u>	1.2
	735,900	

The Charotan and Nepani areas of Bombay state are known for bidi tobaccos; the Gentur-Godavari area in Andhra state (formerly part of Madras state) for better grade cigarette leaf, including flue-cured and a small amount of burley, as well as Natu (dark sun-cured); and the Coimbatore district of Madras state for chewing and cigar tobacco.

Nicotiana rustica, used to prepare hookah (water-pipe tobacco) and chewing tobacco, is found growing in Uttar Pradesh, Bihar, and West Bengal where hookah smoking is prevalent.

About 85% of total leaf production is consumed domestically. Bidi (a cigarette tobacco containing granulated tobacco wrapped in the leaf of Indian ebony, Diospyros sp.), hookah, and chewing tobaccos account for 80% of total domestic use. Cigarette production is on the rise and should cause increased interest in growing flue-cured and burley

tobaccos. Most of the exported tobacco is flue-cured; Natu is next in importance, followed by burley and other types. The major countries receiving Indian tobacco late in the 1950's included United Kingdom, Communist China, Aden, Japan, Indonesia, Hong Kong, and the Netherlands.

#### a. Flue-Cured Tobacco

The center of flue-cured production is Guntur in the southern district of Andhra Pradesh where 186,975 acres were grown in 1960-1961. The northern district of the same state with a production center in East Godavari grew tobacco on 50,064 acres. These two areas accounted for 96% of total production; the remaining was primarily produced in Mysore (7,000 acres) with small and decreasing plantings in Bihar, Bombay, and Punjab.

The tobacco soils of Andhra Pradesh are black clays commonly known as black cotton soils. Clay content in both the surface and sub-surface soil may be as high as 80%. Because these soils become waterlogged when seedlings are grown, this phase of the operation is centered in the sandy coastal areas of Chirala and Bapatta. Seedbed and field operations are commonly started a month earlier in the northern district of Andhra Pradesh than in the southern district. Beds are seeded from 1 August to 1 October, with mature seedlings available from 15 September to 1 December. A high cultural level is used as evidenced by fertilization of seedbeds and treatment of seeds prior to broadcasting. Plowing begins in June and planting is done by hand from late September until December in the northern district, but only from 15 October to 10 December in the southern. Priming of the earliest plantings can start by 1 December and continues until 15 March or into April in the Guntur area.

There are 13 marketing centers in Andhra Pradesh as well as 11 grading centers and 28 redrying plants; all except four are near or in Guntur. Farmers market their crops after flue-curing but without sorting. Agronomic problems of flue-cured production are such that greater yields or better quality will probably not develop. This is true because (i) clay soils with high mineral content predominate; (ii) the crop thrives on stored water; (iii) neither potassium (P) nor phosphorus (K) elicit a response; (iv) soil pH ranges from 7.5 to 8.1; (v) calcium and magnesium levels are high; and (vi) maximum nitrogen fertilization is 20 pounds per acre.

#### b. Bidi Tobacco

The plebian bidi exceeds the cigarette in use by more than four to one. Nearly all bidi tobacco is produced in the western part of India. In 1957 the Charotar area north of Bombay produced 52% of the total, and the Nipani area in southern Bombay and adjacent Mysore produced 39%. The balance is scattered through other parts of Mysore, Madras, and Andhra Pradesh.

The culture of bidi varieties resembles closely the practices used for fire-cured tobacco in the United States except for the method of curing. Field planting starts in mid-August as rains are decreasing and extends until mid-September. Plants are spaced three feet each way and are topped to only 11 or 12 leaves. Either priming or harvest of the whole plant is practical and, in either case, field drying on the ground follows for a few days.

c. Hookah Tobacco

Areas producing this type of tobacco lie in the north and northeast, almost in the shadow of the Himalayas, and within the states of Punjab, Uttar Pradesh, Bihar, and West Bengal. Lesser amounts are grown in the more central parts of Madhya Pradesh and in Bombay. Both winter and summer crops are grown in Uttar Pradesh, an early summer crop in Punjab, and winter crops elsewhere.

Hookah varieties fall into two species, Nicotiana tabacum and N. rustica. Varieties of N. rustica with markedly different growth habits and leaf shape have been developed. Jati and Motahari are two varieties grown in West Bengal. Plant spacing ranges from 6 to 9 inches in rows one foot apart in Punjab to conventional spacing of 2½ to 3 feet each way in Bihar. Irrigation is used in all locations except in West Bengal and all production sites are heavily manured. The tobacco is fermented and then pit-cured similar to perique in Louisiana. It eventually is dried and powdered for use.

d. Cigar and Cheroot Tobacco

Tobacco for cigars and cheroots is grown under a diversity of conditions in India. Cheroots use Jati tobacco from West Bengal and narrow-leaf varieties from the Madura and Coimbatore areas of Madras state, plus other types. The typical broadleaf types are grown in Madura. Shade-grown wrappers are being studied in the Dinhata area of West Bengal, bordering on the Rangpur district of undivided Bengal, which was the home of indigenous wrapper tobacco.

Natu, a name applied broadly to native dark tobacco, comprises a group of varieties grown in northern Andhra Pradesh that may be used for cheroots, cheap cigarettes, chewing, snuff, pipe, or scrap tobacco. A total of 172,000 acres is planted to tobacco in that state, the Guntur district accounting for 70,000 acres. Kat-tail is the leading variety. It is grown in the black cotton soils on old village sites or cow pastures where the leaf is sun-cured for 4 to 6 weeks, then it is fermented before using.

Lanka refers to a variety grown on islands in the delta of the Godavari river. It is cured with a combination of air- and pit-curing.

#### e. Chewing and Snuff Tobacco

This tobacco may be obtained from types grown for bidi, hookah, or cigars, but is also grown specifically in Madras and Kerala. In these two states, red, sandy soil is often used for chewing types. Very heavy manuring, wide spacing, low topping, and delayed harvest combine to supply the desired potency. Most of the crop is sun- or air-cured, but smoke-curing is practiced in Jaffna.

### 5. Indonesia<sup>19,21,4,7,9</sup>

The tobacco crop of Indonesia was reported in 1952 by G.W. Van Dyne in USDA Foreign Agricultural Report 68. The flue-cured industry has grown rapidly since 1951 and a new fire-cured industry has been created since 1959.

The islands of Java and Madura, the most densely populated of Indonesia, grow most of the tobacco. Sumatra produces most of the leaf; Bali, Lombok, Sulawesi, and Kalimantan produce smaller amounts.

#### a. Native Tobacco

Tobacco is grown by individual farmers. Native leaf, Krossok, is used for the production of cigarettes and cut tobacco (Kerftabak or kerf). The name Kretek indicates the commercial product, a mixture of kerf, cloves, and incense in a paper-covered cigarette. The name Klobot implies Kretek rolled into a conical shape and wrapped in corn leaves.

#### b. Fire-Cured Tobacco

Fire-cured tobacco is produced in a small area in Garut near Bandung, but the much larger area is near Bojalali in central Java. The Besuki area of eastern Java also produces some of this tobacco. It is grown by native farmers who sell green leaf for curing. Production is now between 4 and 6 million pounds coming from 7 to 12 million acres. It is currently not an export item.

#### c. Cigar Tobacco

Cigar wrapper is cultivated in the Deli district located in northeastern Sumatra near Medan. Two less-publicized areas are central Java near Jogjakarta and Surakarta (Solo) and extreme eastern Java in the Besuki area. The southern part of the central Java tobacco area is also known as Corstenlanden or Kesultanan. Within it are three government and three private estates. Cigar wrapper is worth \$15 million in foreign exchange yearly.

Cigar filler and binder is native tobacco, "Krossok" and is produced in the Besuki area. This tobacco sells for 300 to 350 rupiahs per kilo ready for export and is the most sought-after export tobacco. This tobacco represents about one-half of the total tobacco export of the country.

d. Flue-Cured Tobacco

East Java grows most of the crop on 90,000 acres; central Java grows 8,700 acres, the Macassar area of Sulawesi somewhat less; and Bali, Lombok, and Madura grow a limited number of acres. Their flue-cured tobacco originated from type seed obtained in Virginia but is inferior in quality. Land devoted to flue-cured accounts for 135,000 of the total one-half million acres.

e. Cigar Production in Central Java

Central Java was once known as Vorstenlanden, but now is known as Kesultanan. Tobacco is grown on six estates and the following facts originate from the owner of one of the estates.

Seedbeds are started in February or March and require only 36 days for seedling production. The beds are 1 x 5 meters and produce 1800 seedlings. Plants are placed about 18 inches apart with three feet between rows. Inorganic fertilizers are used during cropping. Harvest begins 64 days after planting. Field planting is in the dry season and harvest in the wet season. Curing barns are 94 x 18 meters and can handle tobacco from 8 hectares when 1200 kg/ha is expected production. Teakwood is burned from the 2nd to 7th day and thereafter as needed to prevent barn rot.

Culture in the Besuki area of east Java does not vary greatly from Kesultanan. Plantings are grouped into three harvests (Oogsts): (i) Voor - planted during rainy season and harvested at end of rain and beginning of dry season; (ii) Midden - planted and harvested in dry season; and (iii) Na - planted toward end of dry season and harvested during rainy season.

6. Iran<sup>31,4,7,9</sup>

Iran produces oriental, dark sun-cured, flue-cured, and burley tobacco. Most of the oriental tobacco is grown in the northwestern part of the country along the Caspian Sea, with production centered in the districts of Azerbaijan, Giban, Gorgan, and Mazanderan. The production of dark sun-cured tobacco predominates the western part of the country near the border of Iraq. Flue-cured and burley are grown on sandy soils near the Caspian Sea. Tomac is grown as a garden crop throughout the arable areas of western Iran.

Trakizon, Tikulac, Basma, and Samsoun are the major oriental varieties grown. Major export of oriental tobacco is to the USSR since the major Soviet cigarette-producing plants are located close to Tbibsi.

The export price paid for tobacco ranges from \$0.10 to \$0.60 per pound, depending on the quality of the leaf.

7. Iraq<sup>21,4,7,9</sup>

About one-half the tobacco crop is flue-cured. Oriental, burley, and tombac types are also produced. Yields range from 500 to 1000 pounds per acre, depending on rainfall available during the growing season. Growers receive about \$0.45 per pound for the top four grades of leaves.

Eighty per cent of Iraq's tobacco is grown in the Sulaymaniyah area near the Iranian border. Irbil is the next most important area where much flue-cured is grown. Tobacco is also grown in the mountainous northern area where oriental tobacco has been produced for a century. Cultivation of oriental tobacco is extending into the Mosul and Kirkuk areas.

Oriental varieties grown include Khoshnaw, Rawandouz, Renywin, and Sourdash. Some of these varieties were obtained in Greece, Turkey, and Bulgaria. Air-cured tobacco is prepared in a manner similar to that used in the United States for burley in that the leaves are allowed to wilt in the field before they are harvested.

Tombac production is confined to a small area in the northern part of the Middle Euphrates in the Hinidyak vicinity. Seeds are planted in February and the leaves are not harvested until June through September.

Exports are primarily to Kuwait and the neighboring Arab countries.

8. Pakistan<sup>21,4,7</sup>

Most of the leaf produced in this country is grown in eastern Bengal, northwestern Frontier, and Punjab. Dark air-cured and dark sun-cured tobaccos comprise about 75% of the total production.

Tobacco consumption is principally confined to hookah and bidi.

9. Thailand<sup>22,21,7,9</sup>

Tobacco is produced in 50 of the 71 provinces. This widespread distribution is attributed to the growth of the native type grown for home consumption. Native tobacco is cured similarly to that in Indonesia except for the addition of a red dye to the finished product. Large fields of this tobacco are found in the Phrae area. These fields average about 10 acres and are in partially cleared first terraces subject to

river overflow during the monsoon season. Planting is rather haphazard; little or no cultivation is practiced; and no fertilizer is added. Varieties are almost unknown because seed are harvested locally and traded with fellow tobacco growers.

Flue-cured tobacco is produced in the northern provinces. Chiengmai and Chiengrai provinces produce the greatest quantity of flue-cured tobacco; Nongkai, Khonkaen, and Nakorn Panom provinces produce tobacco of less value. All flue-cured production is controlled by the tobacco monopoly.

The monopoly produces 20% of the crop; the remainder is provided by outside growers who receive their seedlings from the monopoly. The farmer pays the monopoly for fertilizers, insecticides, and other farm needs.

The field operation begins in the latter part of the rainy season when the seedbeds, 2 x 10 meters, are fumigated with methyl bromide at the rate of 1 lb/10 sq meters. Seedbeds are planted twice, the earlier planting for the seasonal crop that is grown on land other than that used for rice. The second planting occupies land previously used by rice, a wet-season crop. Beds are planted from mid-August through the end of October in Chiengrai province. Seedlings are transplantable in 30 to 35 days and are planted from the beginning of October through the end of November. Priming begins in 60 days with intervals of 5 to 7 days in early harvest and 10 to 12 days in the latter part of the season.

The greater part of the flue-cured crop follows rice and, in this instance, beds are seeded in late October through mid-November. Field plantings on the reddish sandy loam to grey silt loam begins in late November and continues into early January. First priming occurs after 70 to 75 days' growth. This delay in maturity is attributed to the subsurface hard pan located 8 inches or less from the soil surface.

Burley production is increasing in Sukhothai province and some of the crop has been exported to West Germany.

Oriental production began in Roi-Et province in eastern Thailand. This tobacco is used entirely within the country.

#### 10. Turkey<sup>21,7,9</sup>

Oriental tobacco accounts for 99% of the total tobacco produced. Production is centered in the region adjacent to the Aegean Sea, the Marmara area, the Black Sea, and eastern Turkey.

About two-thirds of the crop is grown in the Aegean area near Smyrna. The four major classes of aromatic tobacco grown here are (i) the Gavurkoy group - heavy leaves, highly aromatic, and a fine texture; (ii) the Basma group - neutral taste; (iii) a group grown near the villages of Papazil-Teholan Issa and Kara-Oghlu, also districts in Manisa and Akhisar; and (iv) the Yerlis group grown in the districts of Bergama and Denizli. The quality of the Yerlis group is inferior to that of the other groups.

The area near the Sea of Marmara and in Thrace near Istanbul accounts for one-eighth of the crop. The types of leaf in these regions are identified by morphological characteristics and named for geographical areas. Duzdje tobaccos have small red leaves, fine texture, and burn well. Izmit leaf is similar to Duzdje except for its milder taste and neutral aroma. Hendek tobacco has larger red leaves that are used for filler. Bursa leaf is medium sized, has a neutral taste, and a mild aroma. Conen leaf is a neutral filler. Trace tobacco occurs in various shades of yellow, is relatively strong, and is used primarily by home smokers.

About one-fourth of the crop is grown in the Black Sea region. This tobacco is in great demand by the United States and European manufacturers, and the types accounting for most of the production are Samsoun, Bafra, Tashova, Basma, and Trabzon. Samsoun, grown in volcanic soils near the seacoast, and Bafra, a larger type of Samsoun, are the most important types grown for export.

Production in southeastern Turkey has increased considerably in recent years. The area grows dark air-cured tobacco and some oriental.

The crop is grown under strict monopoly control with private enterprise encouraged by the technical staff of the monopoly.

#### 11. Mainland China<sup>23,4,7,8</sup>

Tobacco was introduced from the Philippines in the 16th century and is now grown in six provinces: Honan, Shantung, Anhwei, Yunnan, Kweichow, and Lisoning. The principal areas of production are in Honan and Shantung provinces.

The two provinces, Honan and Shantung, account for more than two-thirds of the total flue-cured production, but Anhwei, Lisoning, Kweichow, and Yunnan are also important centers. In the Lisoning province, production is centered in the coastal plains; in the Shantung and Anhwei provinces - near Tsinan and Nanking. Light air-cured tobacco is produced in the same areas, and both are produced in an area bordered by Loyang and Yifeng in Honan province and Ichang and Hankow in Hupeh province. The largest producing site for light air-cured tobacco is located in Kweiyang in Kweichow province.

Dark air-cured production is centered near Siangtan in Honan province.

Cigar tobaccos are produced near Tsuni in Kweichow province and Kunming in iunnan province. Both cigar and light air-cured tobaccos are produced near Canton in Kwantung province.

China is second only to the United States in tobacco production and uses all except the flue-cured tobacco for domestic consumption. In recent years large quantities were used to trade with the "bloc countries" for needed industrial supplies.

#### C. SOUTH AMERICA<sup>24,4,7</sup>

Some of the countries of South America are entirely dependent on outside sources for their tobacco requirements. Other countries can be grouped as self-sufficient, and still a third group supplies its own needs and markets tobacco internationally. The nine countries discussed here are in the second and third categories. Quantitative data on their production and international dealings are shown in Tables 5 and 6.

##### 1. Argentina

More than 95% of all tobacco produced in Argentina is grown in the northern provinces. Some of the more widely grown tobacco varieties include: Criollo, a light air-cured tobacco; Kentucky; Bahia, a cigar tobacco; and Havana. The average yield per acre approximates 800 to 950 pounds.

Farmers receive \$0.35 to \$0.40/lb for flue-cured tobacco and between \$0.22 and \$0.24/lb for burley. In addition to the types of tobacco already mentioned, cigar, oriental, dark air-cured, and some fire-cured tobacco are produced. Tobacco has not been considered an export commodity until recent years.

In the vicinity of Salta, farmers grow one-half of the flue-cured crop and a small amount of burley and oriental. The growers in Misiones province, an area located between Paraguay and Brazil, are expanding the production of flue-cured and dark air-cured tobacco. Some Maryland tobacco is also grown. Darker types of tobacco are produced on the sandy soils found in the provinces of Corrientes and Misiones. Corrientes grows more than one-half of the dark tobacco. In 1960 the major export was dark tobacco.

TABLE 5. TOBACCO PRODUCTION IN SOUTH AMERICA<sup>7, 9, 20, 24</sup>

Country	Type	1947-51	1952-55 <sup>a</sup>	1956-59 <sup>a</sup>	1960-62 <sup>a</sup>	1963
thousands of pounds						
Argentina	Oriental	b	55	770	964	1,105
	Burley	496	b	1,375	1,258	2,249
	Flue-cured	7,983	24,250	21,641	26,751	14,672
	Air-cured, Maryland	6,598	4,189	189	864	882
	Air-cured, Dark	— 43,590	35,992	46,862	73,415	81,952
	Fire-cured	2,473	b	2,095	972	1,323
Bolivia	Air-cured, Dark	700	2,100	2,100	2,100	2,100
Brazil	Burley	2,000	3,638	3,561	3,273	4,916
	Flue-cured	45,498	55,115	77,272	110,603	121,695
	Air-cured, Dark	185,499	252,647	225,176	201,221	223,100
Chile	Burley	171	568	650	1,735	2,121
	Flue-cured	478	639	746	1,184	1,336
	Sun-cured, Dark	14,079	12,318	12,717	15,334	11,020
	Oriental	b	b	b	2	b
Colombia	Air-cured, Dark	45,690	38,366	80,389	72,251	91,261
	Flue-cured	b	b	b	276	551
	Burley	b	b	b	225	662
Paraguay	Sun-cured, Light (Flojo)	14,038	17,306	11,151	18,739	51,138
	Air-cured, Dark (Fuerte)	4,600	4,960	3,531	7,500	15,000
Venezuela	Flue-cured	2,724	8,102	7,869	13,574	11,150
	Burley	1,550	1,984	2,510	6,223	5,450
	Air-cured, Dark	1,950	1,543	617	2,140	1,850

<sup>a</sup> Data in references compiled and averaged.

b Data not available.

TABLE 6. INTERNATIONAL TRADE OF UNMANUFACTURED TOBACCO LEAF IN SOUTH AMERICA<sup>20, 24</sup>

Country	Exports	1935-39	1945-49	1950-54 <sup>a</sup>	1955-59 <sup>a</sup>	1962-63 <sup>a</sup>
thousands of pounds						
Argentina	Exports	180	4,042	973	3,084	26,469
	Imports	16,878	18,322	3,121	155	196
Bolivia	Exports - none					
Brazil	Exports	71,073	b	64,847	63,618	86,062
	Imports	772	b	218	78	9
Chile <sup>7</sup>	Exports	b	b	b	91	b
	Imports	172	817	688	695	879
Colombia	Exports	6,472	6,261	9,315	11,059	23,631
	Imports	138	350	239	13	12
Paraguay	Exports	7,747	10,676	7,267	5,692	23,229
	Imports	202	b	26	5	4
Venezuela	Exports	b	b	b	b	320
	Imports	b	b	601	597	880

<sup>a</sup> Data in references compiled and averaged.<sup>b</sup> Data not available.

## 2. Bolivia

Production of dark sun-cured tobacco is limited annually to about two million pounds that are produced in the highlands of Santa Cruz, Chuguisaca, and Tarija. About 3,000 acres are involved in the production of tobacco.

Bolivia is primarily an importing country.

## 3. Brazil

The major types of tobacco grown in Brazil include flue-cured, burley, native air-cured, twist, and cigar leaf. Total production of tobacco in this country exceeds the combined totals for the other countries in South America. Brazil is the fifth largest tobacco-producing country in the world, preceded in ascending order by USSR, India, Mainland China, and the United States.

Flue-cured tobacco is grown on heavy soil in the central and northwestern portions of Rio Grande Do Sul and in the state of Santa Catarina. The crop is worth about \$0.14 per pound and yields approximately 1,500 pounds per acre. The major portion of the crop is amarillo, a dark, heavy, neutral type. Virginia tobacco represents about 5% of the crop. Until recently the state of Bahia was the leading producer.

Burley is also grown in Rio Grande Do Sul and Santa Catarina on dark soils. It is heavier, darker, and lacks the smoking qualities of United States burley tobacco. There is also a mild, dark air-cured tobacco grown in Rio Grande Do Sul and a red, light air-cured tobacco produced in southern Brazil.

Cigar tobacco is grown in Bahia, Seriqipe, and Rio Grande Do Sul. The tropical coast of Bahia within a 50-mile radius of San Salvador accounts for about 90% of the cigar tobacco crop with Mata Fina as the leading export variety. Cris das Almas is the center for cigar wrapper. The export price for this tobacco varies between \$0.91 and \$1.36 per pound; the price for filler is about \$0.25 per pound to the farmer.

Twist tobacco is grown primarily for the natives and is worth about \$0.10 per pound.

The tobacco exports of Brazil provide about \$200 million in revenue to the government. It is the world's largest exporter of dark, air-cured cigar tobacco.

#### 4. Chile

Most of the annual crop of 17 million pounds is grown under irrigation in the central fertile valley in the province of Aconcagua. Paraguayan varieties are grown on 85% of the acreage. Havana varieties account for the remainder. Valparaiso, San Fernando, and Santiago are the centers of Chile's tobacco industry.

Dark sun-cured tobacco is the major type grown, along with some burley and flue-cured. Flue-cured tobacco produced at the rate of 1,400 pounds per acre is valued at \$0.42 per pound. Burley nets from \$0.08 to \$0.16 per pound and yields approximately 850 pounds per acre per year. Dark sun-cured is worth about \$0.10 per pound.

Chilean exports of tobacco are insignificant.

#### 5. Colombia

Colombia is the second largest tobacco exporter in South America. The most important producing area, the Department of Santander, located north of Bogota accounted for 42% of the 1960 crop. The lowland areas of Bolivar and Magdalena are also important in over-all crop production. The Cauca valley is noted for its cigar leaf, especially filler, which is similar to but no substitute for Cuban filler. Some flue-cured tobacco is produced in the southern district of Magdalena.

Most of the export tobacco is grown in the coastal area. About 20 million pounds are exported annually.

#### 6. Ecuador

Most of the yearly production of two million pounds of dark air-cured tobacco is grown in the El Ora and El Guayas provinces, but the best quality tobacco is produced in Esmeraldas province.

#### 7. Paraguay

Tobacco is grown primarily in the southeastern part of the country in the districts of Caraguatay, Yhu, Quindy, and Caazapa. Most of the crop is composed of a light sun-cured type called "Flojo" although "Fuerte," a dark air-cured type, is being grown for export.

Paraguay has been a relatively stable country in its tobacco production and the prospects indicate a growing export trade with the European Common Market and North Africa.

### 8. Venezuela

Venezuela until recently was the largest importer of tobacco grown in the United States. Recent legal action banned the importation of this tobacco. This situation caused the amount of tobacco produced domestically to increase. About 80% of the total tobacco produced is grown within a 100-mile radius of Caracas. About 75% of the crop is flue-cured. The remaining 25% of the crop is burley and some dark air-cured. Most of the tobacco grown in Venezuela is irrigated. The flue-cured crop is produced in the dry season under irrigation.

Flue-cured tobacco yields approximately 1,500 pounds per acre and sells for \$1.00 per pound. Present prospects indicate the eventual export of flue-cured, burley, and some cigar leaf.

### 9. British and French Guiana

Tobacco is not grown in British Guiana and most imports are from the United States. French Guiana produces some tobacco for "roll-your-own" cigarettes, but the majority of tobacco is imported from France and Algeria.

## D. NORTH AND CENTRAL AMERICA

The tradition of tobacco culture in Cuba is world-renowned. A less known fact is that Mexico is also an important member of the international tobacco community. Production and disposition of the tobacco grown in these countries and in Santo Domingo are shown in Table 7.

### 1. Cuba<sup>25,4,7</sup>

#### a. Sites

Tobacco is grown in five areas of Cuba: Oriente, Remedios, or Vuelta Arriba, Partido, Semi Vuelta, and Vuelta Abajo. The crops and varieties in each area are characteristic. Following is a brief resume of each region:

##### (1) Oriente

Oriente province produces both cigar filler and cigarette tobaccos. A large percentage of this tobacco is used for export and is called by two aliases, Mayari and Guisa (Guisa - a borough of Bayamo). The region includes the municipalities of Alto Songo, Bayamo, Mayari, and Sagua de Tanamo.

TABLE 7. TOBACCO PRODUCTION AND INTERNATIONAL TRADE OF UNMANUFACTURED TOBACCO LEAF IN NORTH AND CENTRAL AMERICA<sup>20</sup>

Country	Type	1947-51	1952-55 <sup>a</sup>	1956-59 <sup>a</sup>	1960-62 <sup>a</sup>	1963
thousands of pounds						
Cuba <sup>7, 9</sup>	Sun-cured, Dark	b	b	107,506	109,000	b
	Burley	b	b	1,430	1,500	b
Mexico <sup>7, 9</sup>	Flue-cured	b	b	1,425	4,500	b
	Flue-cured	3,579	5,512	3,630	4,369	5,999
Dominican Republic <sup>7, 9</sup>	Burley	1,700	1,764	1,392	8,101	16,019
	Sun-cured, Light	40,046	48,500	39,812	61,668	30,710
	Air-cured, Dark	34,100	32,408	29,443	35,025	22,566
	Air-cured, Dark (Criollo and Olor)	47,178	38,673	43,021	58,107	74,955
<u>International Trade</u>						
Cuba <sup>8</sup>	Exports	27,712	32,600	39,100	41,400	35,000
Mexico <sup>8</sup>	Exports	215	497	550	955	18,650
Dominican Republic <sup>8</sup>	Imports	210	1,857	3,307	4,804	7,162
	Exports	13,652	38,524	29,763	27,389	39,555
	Imports	b	122	86	465	367

<sup>a</sup> Data in references compiled and averaged.<sup>b</sup> Data not available.

#### (2) Remedios or Vuelta Arriba

This region also grows cigar filler and cigarette tobaccos. It includes part of the provinces of St. Clara and Camaguey where tobacco is the most extensively grown. The tobacco is known as tobacco de liga (blending tobacco) and tobacco de exportacion (export tobacco). In the province of Santa Clara are included the municipalities of Cabaiguan, Camajuani, Cienfuegos, Encrucijada, Esperanza, Fomento, San Juan de los Yera, Santa Clara, Santo Domingo, Trinidad, Vueltas, and Yaguajio. The municipalities of Camaguey, Ciego de Avilla, Jatibonico, Moron, and Santa Cruz del Sur are included in the province of Camaguey. Tobacco from this province is called Tamarindo.

#### (3) Partido

The Partido district includes the area near a municipality of the same name in Habana province and districts of Guanajay and Artemisa in the province of Pinar del Rio. This area specializes in wrapper tobacco.

#### (4) Semi Vuelta

Semi Vuelta is in the central part of the province of Pinar del Rio between Consolacion del Sur and Candelaria, including the municipalities of Los Pacacios and San Cristobal. It produces filler and cigarette tobacco.

#### (5) Vuelta Abajo

This region of extreme western Cuba grows the highest quality tobacco. The region is subdivided into six areas on the basis of topography: Costa Norte (north coast), Costa Sur (south coast), Lomas (hills), Llano (plains), Remates, and Guanem.

The most famous district is Llano that includes the municipalities of San Juan y Martinez, San Luis in the province of Pinar del Rio, and the municipalities of Mantua, Vinales, Guane, and Consolacion del Sur. The region produces sun-grown and wrapper cigar tobaccos. Both the Tobacco Defense Commission, the governmental regulatory body, and the Tobacco Experiment Station are located in San Juan y Martinez.

### b. General Culture and Curing

#### (1) Seedbeds

The seedbeds are prepared in March or April, i.e., the initial clearing, plowing, and pulverizing so that the bed has very fine, loose soil; then the beds are seeded in early September with subsequent seedings every 20 to 25 days for two or three periods. A mixture of 30 grams of seed and 40 pounds of fertilizer is broadcast onto two beds

(usually 4 feet wide by 65 feet long) that are then covered with cheesecloth or palm leaves until the plant size approximates one inch in diameter. During this period seedlings are watered daily. A well-managed seedbed can yield 10,000 to 15,000 seedlings in about 35 to 40 days after seeding.

#### (2) Transplanting and Field Culture

The tobacco fields are prepared in June for planting in October. The Cuban crop is planted in three stages - early, middle and late. These designations correspond to intermittent planting dates from October through December, and sometimes into February.

Transplanting is preceded by soaking the seedling beds the night before plants are removed. This procedure minimizes root damage when plants are pulled. Seedlings are transplanted by the finger method, i.e., thumb and forefinger precede root into ground, thus minimizing damage to the root system.

Transplants are irrigated in the Partido, Semi Vuelta, and Vuelta Abajo regions by filling a furrow with water approximately 15 days after they are set. This watering system acts as the first hoeing. Plants are irrigated by flooding the furrows three times, including the time of transplanting. The shade-grown crop in Vuelta Adajo and Partido requires irrigation about four times throughout the growing season. Water is never supplied to plants near harvest. Fertilizers are added only in those areas that irrigate.

In Oriente and Remedios provinces the transplants are placed into moist, recently furrowed soil that has been allowed to settle for 8 to 10 days. There are usually three plants per yard of row.

#### (3) Harvesting

The crop is either primed or stalk-cut, depending on the intended use of the tobacco. Primed tobacco has a higher quality. Shade-grown tobacco in Vuelto Abajo and Partido is primed. Those crops are grown under cheesecloth. Encallados, enclosed fields surrounded by hedges that are covered or stuffed with cheesecloth or palm leaves for wind protection, are also found in these areas.

#### (4) Curing

Leaf is prepared for curing by placing a mancuernas (two leaves with some stem attached) on poles or by stringing individual leaves. The tobacco is left in the field to wilt before being placed in curing sheds to air-cure. Heat is supplied only as needed.

The curing barns have a central aisle with drying racks on either side extending up to or just below the roof line. These barns are oriented in an east-west direction; therefore, the sun heats the sides of the building in the early morning and late afternoon. Palm leaves are used on the thatched roofs of barns in Remedios, Partido, Semi Vuelta, and Vuelta Abajo. Curing barns with thatched roofs predominate only in the Remedios area.

Curing is initiated when the temperature ranges between 70 and 85 F and RH between 70 and 85%.

#### (5) Varieties

The variety, Havanensis, selected by the Santiago de las Vegas Experiment Station, is the type of tobacco originally found in Cuba. It is called tobacco criollo (native tobacco).

Punta de lanza, a variety with a long, narrow, pointed leaf, was commonly grown in the Remedios district before the Tobacco Defense Commission distributed a selection from the San Juan y Martinez Experiment Station. This variety is also known as Puerto Rico and Lengua de vaca.

#### (6) Diseases

Tobacco mosaic is a serious problem throughout the island. Frogeye is found on the lower, lighter leaves when the weather is hot and humid. Infection usually occurs after a few hours of a south wind.

Blue mold, black shank, and broomrape also occur; the former has been serious at times.

#### 2. Mexico<sup>7,8,9</sup>

Tobacco production in recent years has increased appreciably. Flue-cured represents most of the increase. Tobacco exports are increasing and represent a significant portion of the agricultural export revenue.

#### 3. Dominican Republic<sup>7,8,9</sup>

The major export commodity in this country is tobacco. Dark air-cured is the major type produced and exported.

### E. AFRICA

Tobacco for some countries of this continent is the financial source from which industrial development can proceed. Local demand for tobacco is also great, but the types of leaf for the national market and international market differ. Data on production by types and on international marketing are shown in Table 8.<sup>4,7,8,9,28,37</sup>

TABLE 8. TOBACCO PRODUCTION AND INTERNATIONAL TRADE OF UNMANUFACTURED TOBACCO LEAF IN AFRICA<sup>10</sup>

Country	Type	1947-51	1952-55 <sup>a</sup>	1956-59 <sup>a</sup>	1960-62 <sup>a</sup>	1963
thousands of pounds						
Algeria <sup>7,9,26</sup>	Sun-cured, Light	16,500	25,222	18,211	3,254	11,515
	Sun-cured, Dark	4,900	870	673	113	450
	Air-cured, Dark	23,271	17,394	12,664	2,320	7,800
Madagascar <sup>c 7,9,27</sup>	Air-cured, Maryland	—	6,240	7,850	8,350	7,652
	Air-cured, Dark		b	b	1,368	2,249
	Burley		b	b	b	265
	Flue-cured		b	b	b	371
Rhodesia-Nyasaland <sup>d 7,9,26</sup>	Oriental	1,836	564	659	861	1,366
	Burley	1,230	2,174	2,830	5,127	8,890
	Flue-cured	148,000	109,000	206,000	235,000	198,579
	Sun-cured, Dark	4,003	2,482	3,229	4,832	5,238
	Fire-cured	21,889	15,062	24,785	23,628	34,306
<u>International Trade</u>						
Algeria <sup>8, 26</sup>	Exports	24,979	14,637	27,716	19,048	b
	Imports	7,482	6,517	9,856	15,008	10,207
Madagascar <sup>c 8,27</sup>	Exports	5,262	3,676	8,596	8,804	8,162
	Imports	17	b	37	1,256	1,500
Rhodesia-Nyasaland <sup>d 8,26</sup>	Exports	33,405	77,912	116,811	149,496	214,269
	Imports	327	1,307	6,401	4	40

<sup>a</sup> Data in references compiled and averaged.<sup>b</sup> Data not available.<sup>c</sup> Madagascar is now the Malagasy Republic.<sup>d</sup> The federation of Rhodesia - Nyasaland has now become the independent nations of Zambia and Malawi respectively.

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### 1. Algeria<sup>28,4,7,9</sup>

Algerian tobacco consumption and imports have been on the upward trend for the last decade, but farm production has dropped drastically. Algeria produced 65 million pounds of tobacco in 1953, but only 6 million in 1962. The sharp decline was attributed to the blue mold epiphytotic.

Dark air-cured and light sun-cured are the predominant types of tobacco produced. The dark air-cured types are grown in the Kalyle and Mitigkja areas where the Atlas foothills rise south of Algeria. The light sun-cured tobacco is grown near Bone and is used primarily in cigarette and pipe tobacco. Dark air-cured tobacco is used as a blend for lower-priced brands of cigarettes and pipe tobaccos.

Most of the crop is grown by Moslem farmers who work under the Khammasa system, i.e., the landlord receives part of the crop in payment for land usage, fertilizer, and seed. The crop is characterized by narrow leaves, heavy stems, and inferior burning quality.

### 2. Madagascar<sup>\*27,4,7</sup>

Dark tobacco, tobac corsé, was the first tobacco grown in Madagascar and was used solely by the farmers. The sites of production were in the Lake Itasy area near Marinarivo and the plateau area west of the capital, Tananarive. Production was then expanded into the alluvial plains of the west coast from Beroroha north to the Sofia Basin, which is south of Port-Bergé. Production techniques are similar to those used in France.

Production in the plateaus and in part of the Majunga zone on the west coast is achieved by family units. Corsé is the predominant type produced, but Maryland is also being grown by many families and accounts for 40% of total production in the Itasy plateau area. The expansion of dark tobacco production has ceased.

The greatest producing area is the Tsiribihina river basin region in an area including Miandrivazo. Production in this area is 1250, 1070, and 283 pounds per acre for burley, Virginia, and Maryland respectively. This region and the Majunga region near Ambato-Boeni and Port-Bergé, Sofia river basin, offer the best opportunities for the expansion of tobacco production.

Tobacco research is carried out at Station d'Essais d'Ambohimana, which is 40 miles south of Tananarive.

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\* Now Malagasy Republic.

### 3. Rhodesia and Nyasaland<sup>\*28,29,4,7,8</sup>

The Federation of Rhodesia and Nyasaland consisted of Southern Rhodesia, Northern Rhodesia, and Nyasaland.

#### a. Southern Rhodesia

This country is the world's fastest growing major exporter of tobacco. The tobacco industry of more than \$100 million is the chief business in Southern Rhodesia. More than 95% of the tobacco produced is exported. The United Kingdom and the Common Market countries are the major markets for export. Flue-cured comprises 98% of the crop, oriental the remainder.

Approximately 75 of the 2,000 to 3,000 acres of the average farm are planted to tobacco. Average profit from flue-cured is \$250 per acre.

Seedbeds are planted in August when there is little rainfall. Irrigation is required until the rains begin in October. Heavy rains often occur in January, the height of the growing season. Seedlings are transplanted from October to December at a rate of 7,000 plants per acre.

Harvesting begins in January and by March all the lower leaves or lugs are harvested. The middle leaves or cutters are harvested from February to April and the top leaves are harvested from March until May.

Research stations at Trelawney and Kutsaga work to improve quality and to combat pests. Nematodes are the greatest pests in Southern Rhodesia.

Only varieties approved by the government may be planted and all growers must be licensed. Many varieties of the better quality tobacco that are grown in the United States are also used in Southern Rhodesia. Hicks varieties account for about 8% of the crop. Other varieties grown include White Gold, Bonanza, Cash Gold, Dollar, Trelawney GIO, Virginia Bright, White Stem, Orinoco, Willow Leaf, Yellow Mammoth, and Jamaica Wrapper.

#### b. Northern Rhodesia

Tobacco production has tripled in the last 25 years aided by improved transportation to the Salisbury market and by technical assistance from the Kutsaga Research Station. Most of the crop is grown for export to continental Europe.

\* Now Malawi.

More than 93% of the tobacco produced is flue-cured. The world market has required an increasing quantity of medium-priced flue-cured, which is the aim of these farmers. Burley accounts for about 6% of the production, but production is increasing. The remainder is sun-cured, air-cured, and Oriental.

Most of the flue-cured is produced near Lusaka, the area through which rail transportation is available. The Fort Jameson area accounts for the major burley production. Turkish tobacco is grown in the vicinity of Chomo, Kalomo, and Broken Hill.

The soil is fertile and the land elevation between 3,000 and 4,000 feet. The average farmer grows about 50 acres of tobacco and obtains an average yield of 1,000 pounds per acre.

The seedbeds are prepared in August. Heavy rains give tobacco a good start in the dark sandy soil. The quality and price for Northern Rhodesian tobacco is slightly below that for Southern Rhodesian tobacco.

c. Nyasaland

More than 90% of the tobacco grown in Nyasaland is exported. About 50% of the total export is dark fire-cured, the remainder - burley, sun-cured, and flue-cured. Tobacco is the chief export and cash crop, providing a livelihood for about one-third of the population.

About 50,000 African farmers grow dark fire-cured tobacco on average plots of 2 acres with a net annual income of \$100. Practically all of the fire-cured is grown by Africans.

Tobacco farms are concentrated in the central portion of Nyasaland on fertile soil of the western shore of Lake Nyasa. Most of the burley is grown in this area, and also near Lilongwe.

Most of the dark sun-cured is grown on farms near the railroad running from Colomoti to Balaka.

IV. INTERNATIONAL TRADE<sup>30, 28-32</sup>**A. MARKET**

The international export market for leaf tobacco is a very important portion of the total world market. Nearly 1.5 billion pounds, more than one-sixth of the total world production, moves in international trade (Table 9).

Practically every country of the world imports some leaf tobacco. Some important markets such as the United Kingdom, the Netherlands, the Scandinavian countries, and Ireland produce practically no tobacco and import all of their leaf requirements. Many other countries including West Germany, France, Australia, Austria, New Zealand, and Switzerland import a large proportion of their tobacco needs. A considerable group of countries including the United States, India, Italy, and Japan import leaf for blending purposes and at the same time export leaf to other countries.

The trend in export demand is for leaf tobacco that can be used in cigarettes because consumer preferences have changed. Light cigarette leaf, flue-cured, light air-cured, and oriental now make up three-fourths of the free-world export trade. Prior to World War I, dark air-cured tobacco made up 75% of the world trade.

Tobacco types vary remarkably from area to area, for no other plant is more highly sensitive to its environment. The variations, like those in other plants, arise partly from different seed, culture, and processing practices and from even slight differences in climate and soil.

Leaf tobaccos throughout the world range (i) in size - from the tiny leaves of the better aromatic varieties of the Near East to the extremely large, broad leaves of the American cigar tobaccos; (ii) in thickness - from the paper-thin Japanese light air-cured to the thick makhorka of the Soviet Union; and (iii) in flavor - from the neutral flue-cured grown in most tropical areas to the very strong Nicotiana rustica of India and the Middle East. The tendency of the tobacco plant to vary greatly according to environmental conditions has led to classification of leaf tobacco by curing methods. Inherent characteristics, the results of genetics and breeding, and the influence of soil and climate also play an important part in classifying tobacco.

**B. QUALITY**

Historically, tobacco has been sold on the reputation of the leaf quality produced in specific growing areas. The appearance of the leaves has been the principal basis for judging the desirability and, therefore,

TABLE 9. ARABLE LAND, TOBACCO ACREAGE, AND VALUE OF TOBACCO FOR SELECTED COUNTRIES OF THE WORLD<sup>10, 20</sup>

Country	Arable Land and Land in crops, ha	Tobacco				Exports		1959-1961					
		Area, 1000 ha		Yield, 100 kg/ha		Total	Other	Agricultural					
		1948-53	1960-62	1948-53	1960-62			Other than food, feed, forest	Tobacco unmanu- factured	% total			
————— Million U. S. Dollars ———													
EUROPE													
Bulgaria	4,619	73	97	6.1	7.0								
France	21,405	29	25	17.2	18.3	6388.0	5161.4	219.8	6.4	19.2			
Greece	3,701	84	98	5.8	7.3	210.2	36.5	112.3	74.7	82.7			
Hungary	5,624	22	16	10.0	12.2								
Italy	12,608	56	52	13.4	12.2	3599.4	2934.4	82.5	15.2	18.7			
Poland	10,170	19	37	14.3	12.3								
Romania	10,393	32	29	5.3	6.9								
Spain	20,730	14	18	13.9	16.4	645.1	273.4	13.4	0.2	58.2			
Yugoslavia	8,382	34	37	7.1	13.3	537.2	292.5	36.8	17.9	45.5			
U.S.S.R.	228,690	213	150	7.4	12.1								
ASIA													
Burma	3,614	48	44	9.2	9.5	221.5	12.9	13.3		94.2			
Cambodia	2,353	8	10	5.3	6.2								
Malasia	2,186	2	2	6.8									
India	161,062	331	378	7.5	7.7	1342.5	733.6	167.2	29.9	45.5			
Indonesia	17,681	139	188	4.8	4.2	856.4	84.1	438.6	26.3	66.8			
Iran	16,850	16	19	7.9	5.8								
Iraq	7,496	4	12		9.0								
Laos	1,000	2	2	5.3	5.4								
Pakistan	29,453	69	81	9.9	11.3								
Thailand	10,077	33	54	8.3	14.3	415.5	45.3	147.0	1.1	89.0			
Turkey	25,167	122	168	7.6	7.2	340.5	32.8	166.5	81.4	90.3			
Vietnam	4,200		7		8.5								
China, Mainland	109,354	186		11.8									
SOUTH AMERICA													
Argentina	30,000	32	40	10.4	10.9	1017.4	46.7	281.8	0.8	95.4			
Bolivia	3,091	1	1	6.6	7.1								
Brazil	19,095	149	211	7.6	7.7	1314.2	164.9	157.1	20.3	87.5			
Chile	5,514	3	3	20.3	22.6								
Colombia	3,062	20	18	10.4	17.4	453.1	90.1	10.8	3.1	26.0			
Paraguay	517	2	9	11.1	10.4								
Venezuela	5,220	11	7	8.5	11.9	2399.3	2366.2	0.3		1.4			

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TABLE 9. (contd)

Country	Arable land and land in crops, ha	Tobacco				Exports 1959-1961			
		Area, 1000 ha	Yield, 100 kg/ha		Total	Other	Other than food, feed, forest	Tobacco unmanu- factured	% total
<b>NORTH AND CENTRAL AMERICA</b>									
Cuba	1,970	55	57	6.6	8.3				
Mexico	19,928	35	54	10.0	13.7				
Dominican Republic									
<b>AFRICA</b>									
Algeria	7,066	29	18	6.6	5.9				
Madagascar	1,395	6	6	6.4	6.2				1.1
Rhodesia- Nyasaland	35,264	132	152	5.2	11.9	559.6	418.6	110.3	104.9
									25.1

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the value of the commodity within these areas. Many cured leaf tobaccos offered for sale on various world markets have a very good appearance but lack the quality expected. Leaf characteristics vary widely among growing regions. Therefore, leaf appearance is not a reliable indicator of quality.

Quality is one of the governing factors in international leaf trade at some world markets and, as such, must be defined. It is generally concluded that the quality of leaf tobacco is a summation of those characteristics that adapt the leaf for its intended use. These characteristics include color, texture, body, strength, flavor, aroma, burning rate, and manufacturing qualities.

Quality is a term known and frequently used by all involved in the tobacco business. Everyone feels that he knows what is meant when the word is used; yet no other term causes as much confusion and misunderstanding within the industry. Many misunderstandings arise because manufacturing requirements change from year to year. This comes about by introducing new products and changing consumer demands for different brands of old products. Chemical changes from crop to crop affecting strength, flavor, and aroma are responsible for some of the variations in buying emphasis; also, changes in consumer-buying patterns sometimes call for leaf of different chemical characteristics. Thus, even though the empirical values for quality do not change, the real factors do.

International trade is governed primarily by the needs of the buyers rather than the supply available from the sellers. The elements of competition that apply to international trade in leaf tobaccos are simple but often misunderstood. If the buying requirement exceeds the amount of leaf available on the markets, then buyers obtain as much tobacco as they can, regardless of any other consideration. When this situation does not exist, then other factors come into play, viz., the availability of foreign currency, quality, politics, and trade agreements.

The availability of foreign currency with which to buy foreign commodities in international trade is determined by the balance-of-payments position of the importing country. This is an important factor for all importing countries. The buyer must decide how much he can pay by judging the reaction of the ultimate consumers. Tables 10 and 11 show the price range paid by various countries for the same product.

Quality is the final determining element in the international market. Although all markets like good quality leaf, quality is more important in some markets than in others. Where internal competition in sales is not a factor, as is true of monopoly countries, quality is less important; however, in most countries the quality of the leaf is an important factor.

TABLE 10. TOBACCO PRODUCTS IN SELECTED COMMON MARKET COUNTRIES 1957<sup>31</sup>

Country	Source of Imports	Quantity, 1000 lbs	Value, \$1000	Average Import Price, U.S., Cent/100
France	United States	8,703	4,149	56.5
	Turkey	802	276	34.4
	Rhodesia	558	205	36.7
	India	551	60	10.9
	Greece	11,137	5,293	45.9
	Turkey	6,982	3,652	52.4
	Brazil	5,761	1,976	35.3
	Colombia	1,111	205	18.2
	Mexico	8,906	6,179	75.6
	United States	75,018	11,821	47.2
Germany	United States	8,673	12,725	146.7
	Indonesia	474	237	50.0
	Canada	115	61	55.7
	Colombia	5,971	3,567	73.8
	Greece	1,678	955	56.5
	India	2,083	377	18.1
	Rhodesia	7,954	2,320	29.7
	Cuba	2,895	1,243	42.9
	Dominican Republic	459	136	29.0
	Italy	5,589	6,494	80.5
Italy	United States	9,244	7,099	76.8
	Greece	6,885	3,469	71.0
	Turkey	—	—	—
	United States	64,109	43,582	68.0
	Rhodesia	2,972	1,215	40.9
	Canada	1,962	975	49.7
	Greece	37,337	22,416	60.0
	Turkey	13,577	9,119	72.0
	India	1,9	75	44.4
	Indonesia	6,148	9,576	138.4
West Germany	Brazil	10,168	3,772	37.1
	Italy	5,030	2,166	42.2
	Colombia	6,600	1,672	28.4
	Thailand	1,296	534	41.7
	Dominican Republic	5,105	1,055	20.7
	Colombia	4,673	1,392	35.6

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TABLE II. COMPARATIVE EXPORT PRICES OF SELECTED COUNTRIES FOR SPECIFIC TOBACCO TYPES<sup>20</sup>

Type	Producing Country	1950	1951	1952	1953	1954	1955	1956	1957
		United States, cents/lb							
Flue-cured	United States	53.5	64.5	63.1	66.8	68.9	67.3	66.6	72.9
	Canada	49.8	56.8	58.3	55.8	57.3	57.3	58.6	59.7
	India	a	29.1	34.3	33.9	30.2	28.6	29.0	35.6
	Rhodesia-Nyasaland	54.5 <sup>b</sup>	56.5 <sup>b</sup>	59.8 <sup>b</sup>	61.3	58.3	61.4	50.6	60.2
Burley	United States	40.5	46.9	53.9	52.2	51.4	55.9	58.7	76.3
	Canada	a	39.7	44.9	44.2	44.0	43.0	41.6	43.6
	Italy	a	32.7	a	32.8	31.4	35.5	34.2	37.9
	Nyasaland	a	a	a	a	a	42.7	39.7	53.8 <sup>c</sup>
Fire-cured	Japan	a	a	a	a	a	a	24.3	29.7
	United States (Virginia)	53.0	59.0	63.7	64.6	62.5	62.4	51.8	63.8
	United States (Kentucky)	41.0	39.7	47.8	49.0	50.7	52.6	51.9	48.6
	Nyasaland (Kentucky)	30.6	23.8	27.9	27.7	26.1	30.4	29.8	31.0
Dark Air-cured or Sun-cured	Italy (Kentucky)	a	a	a	a	24.5	23.5	26.5	26.7
	United States (Green River)	44.9	27.7	46.9	30.2	35.6	41.5	34.7	38.8
	United States (One Sucker)	55.6	46.4	76.1	65.9	59.1	25.	26.8	35.9
	Nyasaland	34.3	32.3	32.7	34.6	29.4	32.6	a	a
	Colombia	10.5	11.2	12.2	12.3	11.7	11.3	a	15.1
	Dominican Republic	14.8	16.3	15.7	18.7	18.1	16.9	17.2	19.0 <sup>d</sup>

<sup>a</sup> Not available.<sup>b</sup> Southern Rhodesia.<sup>c</sup> Approximately 50% of exports were in the form of strips at an average price of 56 cents per pound.<sup>d</sup> For first 8 months only.

### C. POLITICS

In addition to these natural economic factors, international trade must face political problems. Economics cannot be divorced from politics in foreign trade. Governmental influence on the direction and volume of international trade in tobacco is often merely an extension of the natural factors of competition. For example, a shortage of foreign currency may develop. The buying government may, as a result, put restrictions of one sort or another on expenditures for tobacco.

Often, however, governmental policy is completely arbitrary, and it is aimed at directing trade toward particular countries, regardless of normal commercial considerations. Such action on the part of tobacco exporting countries is to gain guaranteed markets for their leaf exports.

Many competitors of the United States are increasingly favored by restrictions imposed by foreign governments to keep imports from the United States as low as possible. Restrictions include bilateral trading arrangements of various sorts (Tables 12, 13, 14), preferential tariffs, monopoly practices, licensing and exchange controls (Table 15), and import quotas. Bilateral arrangements are becoming of greater importance as a method of moving tobacco abroad from such countries as Greece, Turkey, the Rhodesian Federation, Yugoslavia, and India.

There are no world prices for tobacco, such as those for cotton and wheat, based on uniformly recognized grades and qualities. The tremendous range of prices for different grades of tobacco internationally complicates analyzing the effect of these price differences on exports (Tables 10, 11, 16). There have been increasing complaints, especially from tobacco importers and manufacturers of Western Europe, that prices for United States leaf tobacco are much too high when compared with prices for similar tobaccos produced by our competitors. Generally, the United States tobacco grower has competed "price wise" with the better qualities of cigarette tobaccos produced abroad. Foreign grades control the market of medium- and low-quality leaf. This disparity in prices for the low and medium grades has increased during the past several years. In part, this is due to larger demands from domestic manufacturers who use these lower grades in filter cigarettes. It is the opinion of European tobacconists that U.S. tobacco is already priced out of some markets and with the reduced acreage and the support price under the present parity formula, in time, will be priced out of most markets.

TABLE 12. BILATERAL TRADE AGREEMENTS OF SELECTED COUNTRIES THAT INCLUDE  
TOBACCO AND TOBACCO PRODUCTS FOR EXPORT<sup>30</sup>

Exporters	Importers															
	Bulgaria	France	Greece	Hungary	Italy	Poland	Romania	Spain	Yugoslavia	U.S.S.R.	Mexico	Burma	India	Turkey	Pakistan	China, Mainland
Bulgaria	a		a	a	a											a
Greece	a,b		a	a	a		a	a	a	a,b		a,b				
Italy	a				a	a						a				
Yugoslavia					a								a			
Cuba			a		a,c	a,c		a	a							a
India	a,d		a,b	a,b	a,c			a	a		a			a		
Indonesia					a				a							
Iran	a															
Iraq					a											
Pakistan					a											
Turkey	a			a	a	a	a	a	a	a						

a. Unmanufactured tobacco.

b. Cigarettes.

c. Cigars.

d. Other.

TABLE 13. BILATERAL TRADE AGREEMENTS OF SELECTED COUNTRIES THAT INCLUDE  
TOBACCO AND TOBACCO PRODUCTS FOR IMPORT<sup>30</sup> 57

Importers	Exporters										
	Bulgaria	Greece	Italy	Yugoslavia	Cuba	India	Indonesia	Iran	Iraq	Pakistan	Turkey
Bulgaria			a			a, d					a
France	a	a, b						a			
Greece						a, b					
Hungary	a	a			a	a, b, c					a
Italy	a	a			a	a		a	a		
Poland	a	a	a	a	a, c	a, d					a
Romania											a
Spain		a	a		a, c						a
Yugoslavia		a				a					a
U.S.S.R.		a			a	a	a				a
Mexico		a, b									
Burma						a					
India		a, b	a								
Pakistan						a					
Turkey				a							
China, Mainland	a				a						

a. Unmanufactured tobacco.

b. Cigarettes.

c. Cigars.

d. Other.

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TABLE 14. COST OF TOBACCO IMPORTS BY EUROPEAN ECONOMIC COMMUNITY COUNTRIES FROM SELECTED COUNTRIES COMPARED BY OLD RATE OF DUTY AND BY THE NEW COMMON MARKET RATE<sup>31 a</sup>

Type and Supplying Country	Importing Country									
	Germany		Netherlands		Bel.-Lux.		France		Italy	
	Old	New	Old	New	Old	New	Old	New	Old	New
U. S. Cents Per Pound										
Flue-cured										
U.S.A.	89.4	87.3	54.5	64.9	50.0	59.4	80.7	97.9	77.7	94.9
Canada	68.6	66.5	45.4	54.8	38.6	48.0				
Rhodesia	58.0	51.9	30.6	40.0	36.5	45.9	50.1	64.1		
India	31.5	25.4	17.7	31.6	16.8	26.0	15.4	28.6		
Italy	64.0	44.7	44.4	40.6	42.8	39.0	36.3	36.3		
Burley										
U.S.A.	97.2	95.1	69.6	83.0	60.2	72.2	83.0	100.2	87.2	104.4
Canada	72.1 <sup>b</sup>	68.6 <sup>b</sup>	57.7	69.0	55.3	65.9				
Japan	55.0	48.9			27.0	36.4				
Italy	62.1	42.8	33.3	29.5	29.5	25.7	36.3	36.3		
Dark fire-cured										
U.S.A. (Ky.-Tenn.)	62.1	56.0	48.8	58.2	36.9	46.3	51.3	65.7	83.8	101.0
U.S.A. (Virginia)	97.0	94.9	74.5	87.9	44.3	53.7	62.0	79.2	67.3	84.5
Rhodesia and Nyasaland			23.7	33.1	31.3	40.7				
Italy	56.7	37.4	31.3	27.5	37.1	33.3				
Oriental-type										
Greece <sup>c</sup>	77.0	57.7	41.0	37.2	35.6	31.8	49.3	49.3	77.0	77.0
Turkey	80.0	97.2	44.9	58.1	39.1	52.3	64.4	81.6	61.7	78.9
Yugoslavia	56.5	73.7	35.9	49.1	29.3	38.7	47.4	60.6	48.5	62.1
Italy	50.1	30.8	33.7	29.9						

a Average 1958 export price plus effective duty.

b Canadian costs to West Germany based on 1959 average prices.

c Greece is becoming an associate member and will ultimately receive duty-free treatment. Zero duty was used in calculating costs for Greek tobacco imported by member countries under the new rate.

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TABLE 10 - LICENSING AND EXCHANGE REQUIREMENTS FOR SELECTED COUNTRIES<sup>30</sup>

Country	Import Licensee			Remarks	Exchange Permit		
	Required Yes	Required No	Optional Yes		Required Yes	Required No	Remarks
France	X		X			X	
Greece	X			Import approval required.	X		Application for foreign exchange must be registered.
Italy		X	X			X	
Spain	X		X		X		Requires 25% advance import deposit.
Argentina		X		Imports subject to exchange surcharge.		X	
Bolivia	X					X	
Brazil	X					X	Exchange for imports sold at auction.
Chile		X		Prior registration and guaranteed deposits.			Processed or manufactured tobacco prohibited.
Colombia	X			Import registration certificate issued with deposit.		X	
Cuba				State-owned bank (BANEC) is sole importer.			All payments by BANK.
Dominican Republic	X						Applications require Central Bank approval.
Mexico	X					X	
Paraguay		X		Subject to deposit before shipping.		X	
Peru	X		X			X	
Venezuela	X						Imports subject to exchange control.
Algeria	X					X	
Malagasy Republic	X					X	
Rhodesia-Nyasaland	X					X	
Burma	X					X	Import restricted to Burmese nationals.
Cambodia	X					X	Cigarettes prohibited.
India	X					X	
Indonesia	X					X	
Iran	X		X			X	
Iraq	X		X			X	
Laos		X				X	
Malaya	X					X	
Vietnam	X					X	
Thailand		X	X			X	
Vietnam	X					X	
Turkey	X		X			X	

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TABLE 16. UNITED STATES PRICES PER POUND OF PRINCIPAL TYPES OF TOBACCO  
EXPORTED TO THE UNITED KINGDOM<sup>20</sup>

Tobacco Types	1950	1951	1952	1953	1954	1955	1956	1957
U.S. Cents Per Pound								
Flue-cured	63.6	66.0	68.6	70.7	73.4	71.4	71.3	77.5
Burley	62.7	61.9	66.1	67.0	73.0	76.8	72.0	80.5
Dark-fired Kentucky-Tennessee	41.8	43.6	45.6	54.4	68.6	40.4	58.4	60.4
Virginia Fire-cured	48.9	50.1	70.5	74.6	67.7	70.2	66.6	73.4
Green River	45.7	35.0	46.0	37.4	51.2	45.7	47.0	57.5
Cigar Wrapper	300.0	200.0	300.0		184.6	180.8	260.0	268.2
Cigar Binder	220.0	107.7	100.0	146.7	75.0	75.0		
Perique	87.5	83.3	89.7	113.9	120.6	77.9	108.3	120.6

V. TOBACCO DISEASES<sup>33-38</sup>

Tobacco diseases pose a constant threat to the growers. Sanitation, selection of proper soil type and of appropriate planting date, soil fumigation, timely application of fungicides and use of resistant varieties to meet the challenges in specific producing areas are the control measures available. Diseases annually take their toll, usually in proportion to the degree of attention given to control measures. Prevalence of diseases by countries and damage inflicted are given in Tables 17 and 18. Diseases are discussed under seedbed, field, and curing.

#### A. SEEDBED

##### 1. Anthracnose

Anthracnose is primarily a seedling disease, but at times affects the lower leaves of field plants. Severe infection of seedlings causes stunting from which plants do not generally recover. Seedlings moderately infected and transplanted will be retarded in growth and are usually rogued and replaced. Anthracnose has occurred in growing areas in Europe, South Africa, and the United States, but is usually of minor importance. The causal agent, Colletotrichum destructivum, has a broad host range, is seed-borne, and overwinters in stubble and plant debris in the field. Disease develops between 64.4 to 89.6 F when a high RH is maintained for 22 hours after inoculation. High soil pH and water-logged soils seem to make the plants more prone to the disease. Certain species within the genus Nicotiana are resistant to the disease, but commercially available varieties have not been selected with this in mind. The disease is chemically controlled with dithiocarbamates.

##### 2. Damping-Off

Damping-off may appear in the plant bed at any stage of seedling growth. There are both root-rot and stem-rot phases of this disease. Seedbed plants and transplants can be infected, and this infection usually occurs at or near the soil line. The disease is usually attributed to Pythium spp., but a complex situation with other facultative parasites may be involved. Although the disease develops at any temperature favorable for plant growth, it is usually most severe at temperatures below those optimal for tobacco - 78.8 to 86 F. Poor drainage, inadequate seedbed ventilation, soil pH between 5.2 and 8.5, and the presence of excess solutes contribute to severe outbreaks of damping-off. Oospores or mycelia overwinter in field debris or stubble. Fungicides or fum'gants are used to control this disease.

TABLE 17. TOBACCO DISEASES IN SELECTED COUNTRIES<sup>33, 34</sup>

Country	Damping-Off	Blue Mold	Anthracnose	Wildfire	Brown Spot	Frog Eye	Mildew	Black Shank	Black Root Rot	Granville Wilt	Tobacco Mosaic	Broomrape	Witchweed
Canada	x	x		x				x	x		x		
United States	x	x	x	x	x	x		x	x	x	x	x	x
Mexico	x	x						x					
Cuba	x	x				x		x			x	x	
Argentina	x			x							x		
Brazil	x		x	x		x					x		
Venezuela	x							x			x		
Malasia	x				x						x		
India	x		x		x		x	x			x	x	
Indonesia	x						x	x			x	x	
Iraq	x						x	x			x	x	
Pakistan	x										x	x	
Turkey	x	x					x				x		
China, Mainland	x	x	x	x	x	x	x	x	x	x	x		
Rhodesia-Nyasaland	x		x	x	x	x	x	x	x	x	x	x	x
Bulgaria	x	x		x				x	x		x	x	
Greece	x	x						x			x		
Hungary	x	x		x	x				x		x	x	
Italy	x	x		x	x		x		x		x	x	
U.S.S.R.	x	x		x	x		x		x		x	x	

x indicates presence of disease.

TABLE 18. TOBACCO DISEASE LOSSES IN NORTH CAROLINA, 1956 TO 1958<sup>35</sup>

Disease	Loss Estimates					
	1956		1957		1958 <sup>a</sup>	
	%	\$	%	\$	%	\$
<u>Flue-cured</u>						
Root Knot & Other Nematodes	5.0	24,409,074	4.0	14,403,300	2.8	11,952,472
Black Shank	1.5	7,323,065	3.0	10,802,680	0.6	2,561,244
Granville Wilt	0.3	1,464,613	0.5	1,800,720	0.1	426,874
Mosaic	1.2	5,858,452	1.0	3,600,620	1.2	5,122,488
Fusarium Wilt	0.1	488,490	0.1	359,980	trace	
Brown Spot	2.0	9,763,801	1.5	5,401,340	0.5	2,134,370
Leaf Diseases	0.1	488,490	0.1	359,980	0.1	426,874
Root Diseases	0.3	1,464,613	0.3	1,079,940	0.4	1,707,496
Plant Bed Diseases (Blue Mold, Anthracnose, etc.)	0.5	2,440,736	0.5	1,800,720	0.2	853,748
TOTAL	11.0	53,699,620	11.0	39,610,100	5.9	25,185,566
<u>Burley</u>						
Wildfire	1.5	159,765	0.5	55,429	0.4	48,000
Mosaic	1.0	106,510	0.5	55,429	0.2	24,000
Black Shank	trace		trace		trace	
Nematodes	0.5	53,255	0.2	22,171	0.2	24,000
Fusarium Wilt	trace		trace		trace	
Root Diseases	0.1	10,651	0.1	11,085	0.3	36,000
Leaf Diseases	1.0	106,510	1.0	110,858	0.8	96,000
Plant Bed Diseases	1.0	106,510	0.5	55,429	0.4	48,000
TOTAL	5.1	543,201	2.8	310,398	2.3	276,000

<sup>a</sup> Value based on crop estimate.

### 3. Blue Mold

Blue mold is caused by Peronospora tabacina and has recently received much attention following its devastating effect on the tobacco farms of Europe, North Africa, and the Near East. The disease is considered a seedbed disease in this country, whereas in other parts of the world it is as serious in the field as it is in our seedbeds. Both Australia and the United States have areas where it is endemic and where strains of the pathogen have been identified. This disease has caused major economic losses in all areas at one time or another, and the necessity of continued chemical control increases the cost of tobacco production. Optimum temperature range for infection is between 60.8 and 69.8 F although the disease develops only when day temperatures do not exceed 80.6 F. High RH and overcast skies will cause sporulation within six days after inoculation. Two weeks of cool, damp weather with overcast skies at the time of seedling growth can cause a complete loss of seedbeds to blue mold. The same conditions favor disease development in the field. Susceptibility is enhanced by succulent or young growth. The pathogen apparently overwinters on perennial tobacco species as oospores, mycelia in debris, or conidia. Varieties resistant to strains of the pathogen are commercially available. The disease can be controlled with dithiocarbamates. Timing of applications is critical for disease control.

## B. FIELD

### 1. Leaf

#### a. Angular Leaf Spot and Wildfire

These diseases are caused by different strains of the same bacterium. The difference in the disease syndrome and symptomatology, however, has lead to distinct names for the two causal agents - Pseudomonas angulata (angular leaf spot) and Ps. tabaci (wildfire). The bacteria are normal inhabitants of the rhizosphere of pasture and weed crops that can overwinter in plant refuse. Seeds also harbor the bacteria and should be treated before seeding. Infection occurs whenever water passage exists through hydathodes, wounds, or stomata. Rainfall, high RH, or dew must be present before infection occurs. Temperature does not seem to be too critical for the development of the disease syndrome, even though optimum development occurs between 82.4 and 89.6 F. Conditions that cause water-soaking are most important when considering epiphytotics of either disease. The diseases are chemically controlled by streptomycin sulfate. Disease-resistant varieties are available.

b. Brown Spot

This warm-weather disease is caused by Alternaria longipes. The lowest temperature for infection is about 68 to 71.6 F; the optimum is about 80.6 F.

Alternaria spores are members of the aerosphere and, as such, are generally present. Virulence of the pathogen increases throughout the growing season following repeated passages through plants. The disease reaches its peak before harvest and can cause extensive damage in a very short period. Wet, warm weather with periods of high RH favor the spread of the pathogen and are prerequisite for epiphytotic development. Dithiocarbamates are used to control this disease.

c. Frogeye

This disease appears in two forms, either on the growing plants as frogeye or on the cured tobacco as green spot. Green spot is a symptom that develops on cured tobacco from infections that occurred before curing. The infected tissue does not lose its green color during curing and these infected areas if abundant on leaves lower the price.

Cercospora nicotianae, the causal agent, is present in plant refuse. Infection occurs through stomata during warm periods, 80.6 F optimum, when either free water or dew is present. The disease is most serious on mature tissue but infection in the seedbed has been observed.

Frogeye can be controlled with the dithiocarbamates and sanitation practices. Resistance to frogeye is generally not included in breeding programs.

d. Mildew

This disease is of major importance in certain areas. Infection occurs in relative humidities of 0 to 100% and in free water. Disease does not develop in areas where the average daily temperature exceeds 77 F, thus this disease is favored by moderate temperatures.

Erysiphe cichoracearum, the causal organism, has many strains, one of which is pathogenic on tobacco and other limited hosts. The organism is affected more by temperature than by RH although spore germination is favored by a high RH.

Infection loci are usually located in damp, shaded, cool areas of the field where the epiphytotic develops.

Resistance to the disease is variable because the same varieties have not responded similarly in different locations. Chemical control is available but chemical residue must be considered.

## 2. Stalk and Root

### a. Black Shank

This disease is devastating. Phytophthora parasitica var. nicotianae, the causal agent, is a facultative saprophyte whose parasitism is favored by warm temperatures and moist soil. The disease affects plants of all ages but causes most damage when epiphytotics develop in maturing fields. Plant death, severe wilt, or leaf lesions can occur following infection. The cured leaf is either worthless or of little value. Foliar infection occurs following irrigation or hard rains but progression of disease will develop only if heavy rains persist.

High soil temperature, 75.2 to 82.4 F, and abundant moisture favor mycelial growth, propagule production, and root infection. Chemical control is difficult and expensive but by proper rotation and incorporation of the dithiocarbamates into the soil it is effective. Disease-resistant varieties are available but variable according to local environment and race of pathogen present.

### b. Black Root Rot

Thielaviopsis basicola is a member of the soil microflora. The strains of the fungus that are pathogenic affect plants of all ages by causing root rot. The disease can cause substantial yield reductions. The disease is favored by moderate soil temperatures, 69.8 to 73.4 F, and moderate to high soil moisture.

Resistant plants are available but must be used on land that is rotated. A high inoculum potential can cause a breakdown of disease resistance.

### c. Granville Wilt

Granville wilt is caused by Pseudomonas solanacearum. The pathogen gains entry into the plant primarily through wounded roots. High temperatures, 86 to 95 F, favor development of this bacterial wilt. It is rarely found in areas where the mean temperature in mid-winter months falls below 50 F. High soil moisture favors inoculum buildup and plant infection.

Resistant varieties have been developed and are in use. Soil fumigation, crop rotation, and sanitary measures should also be used.

### 3. Virus Diseases

#### a. Mosaic

Tobacco mosaic (TMV) is one of the few tobacco diseases found in all geographical areas where the crop is grown. It affects the crop by reducing the weight and quality of the product. The following data of Todd and Nusbaum<sup>36</sup> show what TMV infection can do to yield and price of tobacco leaf.

<u>Inoculated</u>	<u>Price/Acre</u>	<u>Yield/Acre, lb</u>
10 days after transplanting	\$514	1077
40 days after transplanting	568	1149
Topping	674	1339
Check (not inoculated)	705	1383

The virus has many strains and a very broad host range. Infection is inhibited above 100.4 F and symptoms disappear above 98.6 F and below 50 F. The virus remains active for long periods in dried, infected leaves and is primarily spread by man and equipment.

Epiphytotics develop when early infections occur. Farmers are usually unaware of the transmission characters of this virus and act as disseminating agents. Resistant varieties are available but the multiplicity of strains demands crop rotation for control.

### C. DISEASES DURING CURING

#### 1. Houseburn

There are many microorganisms that can affect tobacco as it hangs in barns to dry. Houseburn is a general term for disorders caused during curing. Generally, rainy, damp weather precedes the damage. Some of the microorganisms are active up to 120.2 F so that any curing barn in which supplemental heat is not available is susceptible to one or many of these pathogens. The organisms that cause barn rots include Botrytis cinerea, Sclerotinia sclerotiorum, Rhizopus arrhizus, Alternaria tenuis, Pythium sp., Erwinia aroideae, Penicillium sp., Aspergillus sp., and Cladosporium sp. This list of pathogens contains many saprophytes normally found in the aerosphere. Therefore, it is easy to understand why inadequate curing facilities might cause complete loss of a harvested crop.

2. Green Spot

This disease is caused by Cercospora nicotianae, the causal agent of frogeye. Green spot occurs in the field when the causal organism infects the leaf a few days before picking and when the leaf is not dried quickly enough. The green spots if abundant, cause a decrease in the value of the cured leaf.

D. DISEASES CAUSED BY FLOWERING PLANTS

1. Broomrape

Broomrape is a widely-distributed phanerogam that causes extensive losses in certain parts of the world. The seed must be in contact with host roots to germinate and parasitize. These host roots may be those of seedlings or of mature plants.

This phanerogam may be controlled by fumigating the soil or by killing with herbicides before it flowers.

2. Witchweed

Witchweed has been reported from the warmer growing areas and is often mistaken as broomrape. The seeds are minute and cause the same type of damage as do other phanerogams.

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13 ABSTRACT		
Information on tobacco is compiled chiefly for the period 1950-1963, although some data go as far back as 1935. The report furnishes background information for the layman and researcher on tobacco types, field culture, curing, production by countries, trade, and diseases. Terms that might be confusing are defined. Data are summarized in tables on market value of tobacco by types, production of and trade in the product by countries. Major geographical areas, acreage, money value of tobacco, yields per unit area, bilateral trade agreements between importing and exporting countries, and licensing and exchange requirements for selected countries are also presented.		

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